Prevalence of Occupational Allergies among Dentists of Pakistan: A Cross-Sectional Study

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Abstract

Objective: Occupational allergies pose a serious health risk to dental healthcare professionals, such as physicians, dentists, assistants, and technicians, due to frequent exposure to allergens like latex, chemicals, and dust from various materials. Reactions can range from contact dermatitis to anaphylaxis to severe life-threatening situations. This study aims to evaluate the prevalence, triggering allergens, clinical manifestations, and management of occupational and general allergies among dentists in Pakistan.

Materials and Methods: A cross-sectional survey was conducted with 282 dentists across Pakistan using a pre-validated questionnaire focusing on general and occupational allergies, allergens, symptoms, and treatments. Participants included male and female dentists of varied experience levels. Chi square and Fisher's exact tests were used to assess associations with $p < 0.06$ as statistically significant.

Results: Among participants, 27% (n=76) reported general allergies while 22.7% (n=64) experienced occupational allergies. Mites (32.89%, n=25) and food (23.68%, n=18) were the most common general allergens. Occupational allergens were dominated by natural rubber latex (65.63%, n=42) and cleaning products (59.38%, n=38). Dermatological manifestations (75%, n=57) were the most frequent, and respiratory issues affected over half (51.32%, n=39) of the allergic participants. Females and those with <10 years of experience were significantly more affected. Treatments primarily included oral antihistamines (53.1%, n=34) and topical corticosteroids (28.1%, n=18).

Conclusion: This study emphasizes occupational allergies as a significant issue among Pakistani dentists, predominantly affecting the skin and respiratory systems. Protective measures, alternative materials, and standardized allergy management protocols to safeguard dental professionals' health and productivity should be utilized.

Keywords: Occupational Exposure, Dentists, Allergy Medications

Introduction

Occupational allergies pose a serious health risk to healthcare workers, especially dentists, dental assistants, technicians, and hygienists, as they experience a range of allergic reactions resulting from exposure to various substances in their profession. Dental procedures can lead to allergic reactions such as contact dermatitis, inflammation of the nasal mucous membrane due to dust or airborne allergens, aggravated asthma, and potentially fatal anaphylaxis. Such reactions are especially common among dentists due to frequent hand washing and the use of gloves.[1] Occupational allergies have a dual etiology involving hereditary and environmental components. Workplace allergies affecting dental professionals mostly impact the respiratory system (allergic rhinitis and asthma), the eyes (allergic conjunctivitis), and the skin (e.g., allergic contact urticaria), especially on the fingers and hands, consequently harming an individual's quality of life and productivity at work.[2]

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An allergy is defined by the World Health Organization (WHO) as a hypersensitivity reaction to an allergen, which is otherwise an innocuous environmental antigen, that is triggered by particular immunologic processes. The immunological response can cause various symptoms, ranging from minor ones like sneezing and itching to severe ones like anaphylaxis. This reaction happens when an allergen—a foreign material generally safe to most people—causes the immune system to react inappropriately. According to the WHO, an allergen is any substance that has the potential to cause an allergic reaction. These compounds can be present in food (peanuts, shellfish), the environment (pollen, dust mites), or the workplace (latex, certain chemicals). When an allergic person's immune system perceives some things as hazardous, an improper immune response is triggered.[3,4]

Dental professionals typically experience two forms of allergic reactions connected to their line of work. First, immunoglobulin E (IgE) antibodies are primarily responsible for type I reactions (immediate hypersensitivity), which happen quickly within minutes or hours after interaction with the causal antigen. The latter attach themselves to mast cells and cause them to degranulate, which releases histamine, leukotrienes, and other mediators. They can be more widespread and potentially fatal, resulting in anaphylaxis, or more localized, causing allergic contact urticaria, rhino-conjunctivitis, and asthma.[5]

Second, type IV reactions, also known as delayed hypersensitivity, typically take 24 to 48 hours to manifest

following antigen exposure. The fundamental pathophysiology of allergic contact dermatitis (ACD) is this cell-mediated response, which is dependent on a complicated interaction between antigen-specific T cells and macrophages with dermal and epidermal cells. Type IV reactions are typically confined to the area in contact with the allergen, unlike type I hypersensitivity.[6]

Research has indicated that dentists are frequently exposed to a wide range of occupational allergens. These include the proteins found in latex gloves and dental dams made of natural rubber, (meth)acrylate found in resins, composites, and bonding agents, metals found in prosthetics, restorations, and orthodontic devices, chemicals added to the production of gloves and found in detergents and disinfectants (such as quaternary ammonium compounds), essential oils (such as eugenol), and even lidocaine. Therefore, there is a considerable risk of occupational allergy development connected with several dental operations.[7,8]

Occupational allergies among dentists are a significant health concern, with studies showing that 13.4% of dental professionals in France, 19.23% in the Nordic countries, and 27% in the United Arab Emirates experience work-related skin symptoms. In the Nordic countries, 4.8% of dentists suffer from occupational asthma due to exposure to latex and respiratory irritants.[8-10] In developing countries, the prevalence and impact of these allergies are less well-documented, but studies suggest significant health concerns. This highlights the need for more localized research to understand the specific challenges faced by dental professionals in different regions.[11]

Moreover, there is a critical need for a focused study in Pakistan to address this occupational health concern, even though international literature offers insightful information about the prevalence and causes of occupational allergies among dentists. The socio-economic and healthcare infrastructure context in Pakistan presents unique challenges that could influence the prevalence and management of occupational allergies, such as limited access to high-quality protective equipment, lack of awareness and training on occupational health, and insufficient reporting and monitoring mechanisms.[12]

By investigating the incidence of occupational allergies among Pakistani dentists, this article aims to assess the prevalence, clinical manifestations, and management of occupational and general allergies among dentists in Pakistan, with a particular focus on identifying triggering allergens, their impact on professional work, and the commonly adopted treatment strategies. This will help influence policy and practice targeted at minimizing these risks.

Materials and Methods

A cross-sectional questionnaire-based study was conducted to evaluate the prevalence of occupational allergies among dentists in Pakistan. It was a voluntary study for the dentists, including general dentists and specialists. Undergraduate students were not included. and questionnaires with missing data were excluded from the study.

The Institutional Research and Ethics Committee provided ethical approval (UCD/ERCA/24/284). A non-probability convenience sampling technique was utilized to collect data from participants included in this research. A sample size of 279 participants was calculated with a 95% confidence level, 4% margin of error, and by taking the expected percentage of occupational allergies related to dermatology among dental surgeons as 13.4%. A pre-validated self-administered questionnaire was used.[8] There was a total of 14 closed-ended questions spread throughout three sections of the self-administered survey.

General information, such as gender, age, and the number of years spent practicing dentistry, was covered in the first section. The study focused on professional experience rather than age as a variable for statistical analysis. This decision was based on the assumption that experience better reflects prolonged exposure to occupational allergens, which is a critical factor in developing allergies. In the second section, participants were asked to share details on allergies (kind of allergens, clinical symptoms, therapy) that were not necessarily related to dental work. The majority of the questions in this section of the questionnaire allowed respondents to select one or more answers. The participants were not required to respond to the following questions if they replied negatively to the question "Are you allergic?" To be classified as displaying "general allergies," a respondent had to disclose allergies to at least one category of allergy other than "professional allergens." The final segment of the questionnaire was related to occupational pathologies. Data were collected over four months, from April 2024 to July 2024. The questionnaire was distributed simultaneously both via Google Forms and handouts of the survey. Data was gathered anonymously; no names or personal information, including email addresses, were gathered. The study's participants were informed about the study's objective and their anonymous involvement.

Data entry and analysis were done with SPSS version 25. Nominal variables were presented with frequency and percentage. A chi-square test was applied to see the association between qualitative variables (association of general allergy and occupational allergy with age, gender, and working experience of study participants). A p-value ≤0.06 was considered statistically significant.

Results

In a sample of 288 participants, 27% (n=76) reported having some form of allergy, while 73% (n=206) did not. Among those with allergies, the most common allergens were mites (32.89%, n=25), contact allergies (31.58%, n=24), and food (23.68%, n=18). Drug-related allergies were also notable, affecting 22.37% (n=17). Interestingly, latex and pollen were among the least reported allergens, each accounting for only 2.63% (n=2) of the cases. Clinical manifestations predominantly involved dermatologic reactions in 75% (n=57) of the participants, followed by respiratory symptoms in 51.32% (n=39) and digestive issues in 48.68% (n=37). Notably, multiple symptoms were also common, with 56.58% experiencing two clinical manifestations and 14.47% (n=11) having three. Only 28.95% (n=22) reported a single symptom. Regarding treatment, 42.11% (n=32) relied on medications during acute exacerbation, with 21.06% (n=16) using a maintenance treatment regularly for their allergies. (Table 1)

Table 1: Prevalence of General Allergies and Associated Clinical Manifestations Among Study Participants

Allergies	**n (288)**	**%**
Yes	76	27%
No	206	73%
Triggering Allergens		
	n=76	**%**
Smoke	1	1.32%
Food	18	23.68%
Drugs	17	22.37%
Professional Allergies	14	18.42%
Molds	11	14.47%
Mites	25	32.89%
Animal Dander	15	19.74%
Latex	2	2.63%

Allergies	n (288)	%
Insect Venom	14	18.42%
Contact Allergies	24	31.58%
Dust	8	10.53%
Pollen	2	2.63%
Clinical Manifestations		
Dermatologic	57	75%
Ophthalmic	12	15.79%
Respiratory	39	51.32%
Digestive manifestations	37	48.68%
Severe life-threatening	1	1.32%
Single Clinical Manifestation	22	28.95%
2 Different Clinical Manifestations	43	56.58%
3 Different Clinical Manifestations	11	14.47%
Treatment		
I don't need any treatment	15	19.74%
I take a maintenance treatment	16	21.06%
I take maintenance treatment & medications in case of acute exacerbations	13	17.11%
I take medications in case of acute exacerbations only	32	42.11%

The data revealed that 22.2% (n=64) of participants suffered from occupational allergies with natural rubber latex (65.63%, n=42) and cleaning products (59.38%, n=38) being the most prevalent allergens. In terms of proven allergens, natural rubber latex remained the most significant at 54.69% (n=35), followed by cleaning products at 35.94% (n=23). The impact of these allergies on work was evident, with 28.13% (n=18) requiring temporary work cessation. Additionally, 64.06% (n=41) did not require any work cessation. Management of occupational allergies primarily involved antihistamines (65.63%, n=42) while only a smaller percentage (15.63%, n=10) used maintenance therapy. Corticosteroids were also commonly prescribed, with topical corticosteroids being used by 28.10% (n=18) of participants. (Table 2)

Table 2: Prevalence of Occupational Allergies and Work-Related Allergens Among Study Participants

Occupational Allergies		n (288)	%
Yes		64	22.2%
No		218	77.3%
Triggering Allergens			
		n=64	**n%**
Natural Rubber Latex		42	65.63%
Metals		5	7.81%
Resins		5	7.81%
Cleaning Products		38	59.38%
Professional Medications		11	17.19%
Proven Allergens			
Natural Rubber Latex		35	54.69%
Metals		9	14.06%
Resins		8	12.50%
Cleaning Products		23	35.94%
Professional Medications		9	14.06%
Work stoppage requirement			
Definitive work cessation		5	7.81%
No work cessation has been required		41	64.06%
Temporary work cessation		18	28.13%
Maintenance therapy			
Yes		10	15.63%
No		54	84.38%
Avoid contact with Allergens		42	65.63%
Antihistamine		42	65.63%
Desensitization		6	9.38%
Homeopathy		4	6.25%
Reliever medication			
Oral corticosteroids		14	21.90%
Topical corticosteroids		18	28.10%
Nasal corticosteroids		11	17.20%
Inhaled corticosteroids		5	7.80%
Oral antihistamine		34	53.10%
Topical antihistamine		3	4.70%
Oral bronchodilators		1	1.60%
Inhaled bronchodilators		3	4.70%
No reliever		13	20.30%
Improvement			
Spontaneous		19	29.69%
With maintenance therapy		20	31.25%
With reliever medications		30	46.88%
After remoteness from the work environment	No treatment required	8	12.50%
	With treatment	6	9.38%

The results in Table 3 show that oral histamines were the most commonly used treatment, particularly for metals (66.7%, n=6) and cleaning products (56.6%, n=13). Topical corticosteroids were also frequently used, with the highest usage for professional medication (66.7%, n=6) and metals (55.6%, n=5). Nasal corticosteroids were predominantly used for professional medications (66.7%, n=6). In contrast, inhaled bronchodilators and topical antihistamines had minimal usage across all allergens. These findings indicate that oral antihistamines and topical corticosteroids are preferred treatments for most allergens, whereas inhaled bronchodilators are the least utilized.

Table 3: Prevalence of Medication Use for Different Allergen Exposures

Medications	Natural rubber latex		Metals		Resins		Cleaning products		Professional medications	
	n	%	n	%	n	%	n	%	n	%
Oral corticosteroids	8	22.90%	2	22.20%	2	25.00%	7	30.40%	3	33.30%
Topical corticosteroids	14	40.00%	5	55.60%	5	55.60%	6	26.10%	6	66.70%
Nasal corticosteroids	8	22.90%	4	44.40%	2	25.00%	3	13.00%	6	66.70%
Inhaled corticosteroids	5	14.30%	0	0.00%	0	0.00%	1	4.30%	0	0.00%
Oral antihistamine	19	54.30%	6	66.70%	4	50.00%	13	56.50%	5	55.60%
Topical antihistamine	1	2.90%	0	0.00%	1	12.50%	2	8.70%	0	0.00%
Oral bronchodilators	1	2.90%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Inhaled bronchodilators	2	5.70%	0	0.00%	0	0.00%	1	4.30%	0	0.00%

Allergies and occupational allergies varied significantly with age, gender, and experience. Participants aged <30 years were more likely to experience allergies (80.3%, n=61), with a similar trend observed for occupational allergies, which were significantly higher (78.1%, n=50, p=0.067). There was a statistically significant difference in allergy prevalence based on gender. Females were more prone to have allergies (81.6%, n=62, p=0.001) compared to males (18.4%, n=81). For occupational allergies, 84.4% (n=54) of female participants reported allergies compared to 15.6% (n=10) of males (p<0.001). The odds ratio of 0.348 (95% Cl: 0.183-0.63) for allergies and 0.290 (95% Cl: 0.140-0.600) for occupational allergies indicates that males are less likely to report allergies compared to females. This difference highlights a clear gender disparity, where females are much more affected by allergies both in general and occupational settings. Regarding experience, those with <10 years of professional experience accounted for 91.7% (n=189) of general allergy cases and 90.6% (n=58) of occupational allergy cases, although these differences were not statistically significant. (Table 4)

Table 4: Allergies and occupational allergies in relation to participants' characteristics

		Are you allergic?				Occupational Allergen			
		Yes		No		Yes		No	
		n	%	n	%	n	%	n	%
		76 27%		206 73%		64 22.7%		218 77.3%	
Age (Years)	<30	61	80.3%	177	85.9%	50	78.1%	188	86.2%
	31-39	12	15.8%	24	11.7%	11	17.2%	25	11.5%
	40-49	3	3.9%	1	0.5%	3	4.7%	1	0.5%
	>50	0	0.0%	4	1.9%	0	0.0%	4	1.8%
Test statistics p-value		6.06 0.072(F)				7.45 0.037*(F)			
Gender	Male	14	18.4%	81	39.3%	10	15.6%	85	39.0%
	Female	62	81.6%	125	60.7%	54	84.4%	133	61.0%
Test statistics p-value Odds Ratio		10.81 0.001* (C) 0.348* (0.183-0.63)				12.04 <0.001* (C) 0.290* (0.140-0.600)			
Experience (Years)	<10	70	92.1%	189	91.7%	58	90.6%	201	92.2%
	11-19	5	6.6%	10	4.9%	5	7.8%	10	4.6%
	20-29	1	1.3%	5	2.4%	1	1.6%	5	2.3%
	≥30	0	0%	2	1%	0	0	2	0.9%
Test Statistics p-value		0.985 0.848(F)				1.469 0.741(F)			

Note: (F): Fisher Exact test, **(C)**: Chi-Square test, **p-value<0.001** Statistically significant

DISCUSSION

This study explored the prevalence and clinical characteristics of general and occupational allergies among dental professionals in Pakistan. The prevalence of allergies accounted for 27% (n=76), while occupational allergies were experienced by 22.7% (n=64) of the participants. In contrast to our study, a significant number of dental professionals, 64% in Iran, reported allergic reactions to at least one dental material. However, the study sample of the comparative study included Dental students and Postgraduate students who were still in the learning phase of handling the sensitive allergens.[13]

Mites were the most common allergen for the general allergic reaction (32.89%, n=25). Similar findings were observed in a past study conducted on the Pakistani population, where the prevalence of allergies due to dust mites was 44.6%.[14] However, the German population showed 15.9% sensitization to domestic mites.[15] The variation in results could reflect the environmental factors associated with different geographical locations, lifestyle changes, and ventilation of the indoor environment. The significant number of sensitizations reported by the subjects emphasizes the need for improved ventilation methods, the use of vacuum cleaners, less exposure to furniture and carpets harboring domestic mites, the use of HEPA filters, and regular dust removal protocols in the dental clinics.

Natural rubber latex (NRL) was the most frequently reported allergen(65.63%, n=42) in occupational allergies, followed by cleaning products(59.38%, n=38) in this study. Jaber M. also reported that Natural rubber latex is the leading cause of contact dermatitis among dental professionals.[16]

In contrast to our findings, Warshaw et al. conducted an epidemiological study in North America from 2001-2018, where they determined that 13.1% of the participants were allergic to sterilization solution.[7] However, the increased use of chemical disinfectants in dental practices post-COVID-19 could explain the high sensitization rates in our study.[17] Current findings highlight the importance of awareness about the biological risks and long-term effects of these frequently used chemical products on the local and systemic health of dental personnel.

Regarding clinical manifestations, dermatological symptoms were most common (75%, n=57) among those with occupational allergies, 56.58% (n=43) of the participants reported that they are experiencing at least 2 different clinical manifestations of occupational allergies, closely followed by respiratory symptoms (51.32%, n=39). This distribution aligns with the previous findings, which showed skin manifestations, especially contact dermatitis, are often the first manifestation of occupational allergy due to Natural rubber products in healthcare workers.[18] Thus, the high prevalence of latex-induced allergies needs prioritized efforts to implement alternative materials such as polyvinyl and nitrile gloves among susceptible individuals.

Additionally, respiratory symptoms, experienced by over half (51.32%, n=39) of the allergic participants (22.7%, n=64) in the current study, highlighted the vulnerability of dental professionals to inhaled allergens. Comparable findings were noted in a study where 20.7% of dental professionals reported work-related respiratory symptoms.[19]

The majority of the participants (64.06%, n=41) did not require work cessation, while 28.13% (n=18) experienced temporary work stoppages due to allergy-related issues. A French study reported that around 10.3% of dental professionals experienced temporary work cessation due to allergic reactions.[15] The past survey suggested that general allergic reactions were more common in developing countries.[20] The same factor might be responsible for the difference in the results among comparative studies, where the Dental healthcare workers of underdeveloped countries have limited resources and access to alternative protective equipment.

In terms of treatment, the data indicates that the majority of participants opted for oral antihistamines (53.10%, n=34) and topical corticosteroids (28.10%, n=18) as their primary reliever medications, which is consistent with standard treatment protocols for allergic reactions. Evidence has suggested that the adoption of allergy management protocols should be encouraged in the dental office, which can facilitate awareness, minimize unnecessary exposures, and encourage early treatment.[21] There should be Active involvement of physicians within the health care system, primarily dermatologists and occupational medicine specialists, for effectively diagnosing and managing occupational diseases among dental health care workers.[22]

The study was conducted using online survey forms that have the potential limitation of self-reporting bias. Moreover, the sample was inclined to the younger generation, thus having less experience and working exposure to allergens, which can limit the generalizability of the results. There might be chances that older people are less apt to use the technology and the internet, and may fail to report allergic reactions in the online survey. Future studies with larger sample sizes and balanced stratification of subjects, having more experience, and middle to older age groups could reflect the population appropriately.

CONCLUSION:

This study highlights a notable prevalence of occupational allergies among Pakistani dentists, with 22.7% (n=64) affected primarily by latex and cleaning products, leading to dermatological and respiratory symptoms that impair quality of life and productivity. Females and those with less than ten years of experience reported the highest rates of allergy, pointing toward a need for targeted intervention. Our study advocates for introducing alternative materials, such as nitrile gloves, enhancing clinical ventilation, and establishing training programs on allergy prevention and management, ultimately supporting the safety and productivity of dental professionals in Pakistan.

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2. Anam Imtiaz: Literature search, Write-up of research article, Data collection, Data analysis, Agree to be accountable.
3. Malik Adeel Anwar: Literature search, Write-up of research article, Data analysis, Data collection, Agree to be accountable, Critical reading and revision.
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