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Original Research Article

A cross-sectional survey of awareness, attitude, and preventive measures of occupational hazards by dental students and professionals in Faridabad city

Vishal Kumar Dubey[1], Zaib Mirza[1], V Vanshika[1], Umer Bashir[1], Sapna Rani[1*]

[1]Dept. of Prosthodontics, Manav Rachna Dental College, MRIIRS, Faridabad, Haryana, India

Abstract

Background: Occupational hazards are inevitable risks to health in any occupation, although they are more prevalent among oral healthcare professionals.
Aim/Objective: The present study aims to assess the awareness, attitude, and preventive measures employed by dental students and professionals in Faridabad City, India.
Materials and Methods: In Google Forms or printed versions, a pre-validated questionnaire-based survey was conducted on 379 participants, including dental students and professionals. Questions about their demographic data, awareness, attitude about occupational hazards, and preventive measures were included in the survey. Data was collected in an Excel sheet and tabulated for statistical analysis. The chi-square test will be used for categorical variables with significance $p<0.05$.
Results: The response rate of this survey was 75.8%. Predominantly females were there in the studied population. 40% of the population experienced allergic reactions, predominantly latex gloves and monomers. The majority of the population didn't experience any occupational hazards. Most of the studied population was aware of personal protection. 78.2% of the population had hepatitis B vaccination. 96.6% of the population followed proper biological waste disposal. 93.3% of the population agreed to follow proper recommendations after a sharp injury. Sharps injury showed a significant difference ($p=0.001$) for undergraduates for needle prick injury and explorer prick, while general practitioners and specialists were more exposed to more than one sharp injury. Regarding radiation exposure, undergraduates' awareness was statistically less prevalent ($p=0.001$).
Conclusion: Workshops and seminars should be arranged on the importance of knowledge and prevention of occupational hazards acquired by dental professionals. Prevention of MSP with the incorporation of ergonomics in dentistry is required for dental professionals.

Keywords: Occupational hazard, Allergy, Sharp injury, Dental professional, Survey

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1. Introduction

Occupational hazard or risk is a danger to a person's health condition arising due to the employment environment. It can include the materials used at the workplace or in contact with the working environment, substance, or process that predisposes the employer to any risk.[1] 18th century was the era when Bernadino Ramazzini (Father of Occupational Medicine) recognized the role of occupations in the dynamics of employment health.[2]

Dental professionals are also subjected to various health risks. The procedures and dental materials employed during dental procedures make dental professionals more prone to these hazards. Hazards can be classified into five categories: 1) mechanical hazards are caused by needle pricks or cuts through sharp items etc, 2) physical hazards include harmful radiation exposure like X-ray radiation or laser, etc 3) chemical hazards are due to chemical exposure like amalgam, sodium hypochlorite, caustic materials, metal shavings, etc, 4) biological hazards are due to biological origin, 5) psychological hazards include job-related stress, case -related stress. Nowadays, musculoskeletal problems (MSP) are arising exponentially in dental professionals due to wrong posture or long sitting hours.[3]

Worldwide, dentistry is one of the high-level occupational health hazard professions.[4] Dentists, as well as dental students, are exposed to these hazards, and this is more prevalent in developing countries like India.[5] To provide a

*Corresponding author: Sapna Rani
Email: drsapnadaksh@gmail.com

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safe working environment 'Philosophy of prevention' should be followed.[6] The prevalence of occupational hazards in India varies according to the state and population studied. In Navy dentists, it was MSP that was high,[7] in Andhra Pradesh also, MSPs were the most common hazard encountered by dentists.[8] In Chandigarh, the prevailing cause of injury was from sharp instruments.[9] Although there have been several studies for occupational hazards in several developed nations still there is paucity of literature in developing countries to reach any consensus. Also, continuous monitoring is required to assess occupation-related health hazards and adapt accurate measures to prevent them. Therefore, this study, which relies on a questionnaire, was designed to evaluate the knowledge and practical experiences of dental students and professionals regarding the risks associated with their occupation. Also, their practice to prevent occupational hazards was gauged.

2. Materials and Methods

2.1. Study design

The pre-validated questionnaire was conducted in the Faridabad region in printed version or online Google form for dental students and dental professionals. A pilot study was conducted to check the validity of the questionnaire, and accordingly, the modification was done. The questionnaire underwent pre-testing in a trial phase to assess its functionality, feasibility, and appropriateness, followed by pre-validation to ensure its reliability.

The questionnaire comprised 19 questions, including the demographics and personal information of the population. Most of the questions were multiple-choice-based or dichotomous. The questionnaire was made to evaluate the awareness of the population and preventive measures for the hazards exposed based on the previous study [Supplementary file 1].[9] The institutional ethical committee approved the questionnaire before starting the study (MRDC/IEC/2024/103). The included population was informed about the motive of doing the study and also obtained written informed consent. Inclusion criteria included dental students exposed to clinics, specialists, faculty members, and general practitioners of Faridabad city. Participants with existing musculoskeletal problems were excluded from the survey. All ethical guidelines, including Helsinki (revised in 2013), were followed during the study. The study was conducted between January 2024 to April 2024.

2.2. Sample size collection

There are two approaches for sample size estimation: 1) utilizing existing literature and 2) Conducting pilot testing. In the present study, a pilot study was conducted on 20 participants for a question, and 14 participants answered yes to the question. Based on the calculated effect size of 0.70 (based on a pilot study on 20 participants), 5% precision level, 95% confidence level, and 80% power of the study, the minimum sample size was calculated as 323. The sample size was calculated using nMaster 2.0 (CMC, Vellore).

Formula

$N=Z^2_{1-\alpha/2}p(1-p)/d^2$

where p=absolute proportion, d=absolute precision, 1-α=Confidence interval

2.3. Study population

The study population included 3rd year BDS, 4th year BDS, Interns, Postgraduates of an institution, and private practitioners in Faridabad. The private practitioners who were approached were near Aravali Hills region, Faridabad. Participants were included through convenience sampling. The dental students and staff from dental institutes were invited through Google link. The Google link was generated after entering the questions in Google form in Gmail. The present survey was conducted according to Cherries checklist for E surveys. The first page included the background and objectives of the study along with the research purpose. After their willingness to volunteer to participate, informed consent was implied, which further led to the questionnaire. The key variables measured include awareness of occupational hazards, attitudes toward prevention, and self-reported use of preventive measures. There were no objective measures of exposure. The responses were recorded after pressing the submit button, and it was mandatory to reply to all questions before submission. One submission per participant was allowed, and for students, class representatives shared the link through official mail. After 15 days, a gentle reminder was sent to students and dental staff. The responses from private practitioners were collected by volunteer students on printed questionnaires. Once the sample size was achieved, the survey was closed. The answers on the printed version were entered in an Excel sheet, while responses from Google Forms were also downloaded in Excel format. Both responses were combined and tabulated for statistical analysis.

2.4. Statistical analysis

Data will be analyzed using the Statistical Package for Social Sciences (SPSS) version 27 (IBM Corp., Armonk, NY). Descriptive data will be reported for each variable. Summarized data will be presented using tables and graphs. The chi-square test will be used for categorical variables. The level of statistical significance was set at a p-value less than 0.05. The response rate was 75.8% which was adequate to achieve minimum sample size. There was 2.5% missing data, which was removed while the analysis was done. It was a questionnaire observational study with minimalistic confounding factors.

3. Results

379 responses were obtained out of the 500 population to which the questionnaire was shared. The age group that participated in the survey was predominantly 18-25 years of

age, female, and 3rd year BDS students. The geographic distribution of participants is shown in **Table 1**.

Gender distribution revealed notable differences. The undergraduate group was predominantly female, with 72.44% women. Among general practitioners, females make up 54.39% of the group, whereas among specialists, the proportion of females rises to 78.35%.

Average no of patients was less than 10 in most of the dental set-ups. Needle prick was most common among sharp injuries in population [**Figure 1**]. Upon assessment of allergic reactions towards materials used in dentistry, 40% agreed that they experienced allergic reactions and the most common cause was latex gloves. Burns was the most common occupational hazard encountered by participants. More than 90% population agreed that they wear a face mask, head cap, and gloves during treatment procedures implication while only 63% agreed on wearing eyeglasses. 78.2% population had hepatitis B vaccination but most of them didn't have booster doses for the same. 96.6% study population follow proper waste disposal protocol and 93.3% follow proper protocol after a needle prick or any sharp injury. 93.8% population uses adequate barriers while taking X-rays and only 78.5 % have devices to measure the dose of radiation.

Among the undergraduates (N = 225), 42.22% reported no exposure to any risk of sharp injury, compared to 31.58% of general practitioners (N = 57) and only 3.09% of specialists (N = 97), with a statistically significant difference (p = 0.001) [**Table 2**]. On comparison of the assessment of the prevalence of occupational hazards in different groups viz. undergraduate students, specialists, and general practitioners, 39.56% of undergraduates reported being exposed to aerosols, with higher proportions reported among general practitioners (54.39%) and specialists (46.39%) with a non-significant difference (p=0.105). For allergic reactions, the distribution of sources varies significantly. The most common source for undergraduates was exposure to monomers (16.44%), followed by latex gloves (13.33%), and mercury (6.67%). A smaller percentage reported dust from metal finishing (0.44%) and rubber dams (2.67%). Among general practitioners, latex gloves were the most common source of allergic reactions (26.32%), followed by dust from metal finishing (14.04%) and monomers (14.04%). None reported allergy from mercury or rubber dam exposure [**Table 3**].

Specialists also reported monomers as a common source of allergic reactions (23.71%), followed by latex gloves (8.25%), dust from metal finishing (7.22%), and mercury (7.22%). The p-value for the sources of allergic reactions was 0.001, indicating a statistically significant difference among the groups [**Table 3**]. This suggests that the types of allergic reactions experienced by each group differ systematically, likely due to variations in their clinical duties and exposure risks. Injury to other sharp instruments is described in **Table 3** and the chi-square test confirmed the differences in exposure levels were statistically significant ($p < 0.05$) for most categories, highlighting distinct risk profiles among the groups.

In a comparison of the experience of occupational hazards, a substantial majority of participants across all groups didn't report encountering any occupational hazards. Specifically, 76.00% of undergraduates, 84.21% of general practitioners, and 76.29% of specialists reported no hazards indicating a non-significant difference (p=0.555).

Among those who reported hazards, burns were most prevalent followed by occupation-related stress, although the difference was non-significant (p=0.555) [**Figure 2**]. In a comparison of personal protection taken by participants, all participants agreed that they are using face masks, undergraduates showed significant differences for head cap (p=0.001) while for hand gloves use no significant difference was found (p=0.355). For eye protection, specialists were more aware than the other two categories (p=0.023). For proper healthcare waste management and recommendations after sharp injury, no significant difference was found among the groups (p=0.234, 0.078). Regarding radiation exposure, awareness was statistically less prevalent among undergraduates (p=0.001). [**Table 4**]

Hepatitis B vaccination was also less noticed in undergraduate students (p=0.001). The data indicates statistically significant differences across the groups regarding the timing of hepatitis vaccination. Undergraduates are less likely to have been vaccinated and more likely to forget the date, while specialists and general practitioners have more varied vaccination histories, with some receiving their shots many years ago. Recent vaccinations are more common among undergraduates and specialists, possibly due to different stages in their careers.

Table 1: Demographic and personal data of participants

		Undergraduates N=225	**General practitioners n=57**	**Specialist N=97**
		n	n	n
Age group	18 to 25	214	0	4
	26 to 35	11	40	48
	36 to 50	0	12	40
	51 to 65	0	5	5

Gender	Female	163	31	76
	Male	62	26	21
Average no of patients in your dental setup	<10 patients per day	117	14	43
	>20 patients per day	43	19	11
	10-20 patients per day	65	24	43
How much is your work experience	<6 Months	169	0	0
	<12 Months	56	8	3
	2-5 Year	0	16	29
	5-10 Years	0	18	42
	>10 Years	0	15	20

Table 2: Exposure to allergy or aerosol of study participants

		Undergraduates N=225		**General practitioners n=57**		**Specialist N=97**		**P value**
		n	%	n	%	n	%	
Have you been exposed any aerosol or allergic reaction?	No	136	60.44	26	45.61	52	53.61	0.105, ns
	Yes	89	39.56	31	54.39	45	46.39	
If yes, what was the source of the allergic reaction	None	136	60.44	26	45.61	52	53.61	0.001*, sig
	Dust from Metal Finishing	1	0.44	8	14.04	7	7.22	
	Latex gloves	30	13.33	15	26.32	8	8.25	
	Mercury	15	6.67	0	0.00	7	7.22	
	Monomer	37	16.44	8	14.04	23	23.71	
	Rubber dam	6	2.67	0	0.00	0	0.00	

Chi square test, level of significance set at $p < 0.05$
Ns: non-significant, *sig: significant

Table 3: Comparison of different groups for sharp injury

	Undergraduates N=225		**General practitioners n=57**		**Specialist N=97**		**P value**
	n	%	n	%	n	%	
None	95	42.22	18	31.58	3	3.09	0.001*, sig
Root canal files	0	0.00	6	10.53	0	0.00	
Burs	2	0.89	0	0.00	1	1.03	
Explorer or probe	11	4.89	0	0.00	3	3.09	
Needle prick injury	29	12.89	0	0.00	6	6.19	
Forceps	0	0.00	0	0.00	4	4.12	
Any other sharp instrument	20	8.89	0	0.00	31	31.96	
More than two sharp instruments	65	28.89	33	57.89	49	50.52	

Chi-square test, level of significance set at $p < 0.05$
Ns: non-significant, *sig: significant

Table 4: Attitude toward personal protection

		Undergraduates N=225		**General practitioners n=57**		**Specialist N=97**		**P value**
		n	%	n	%	n	%	
Do you use facemask?	No	0	0.00	0	0.00	0	0.00	Not applicable
	Yes	225	100	57	100.00	97	100.00	
Do you use head cap?	No	3	1.33	7	12.28	9	9.28	0.001*, sig
	Yes	222	98.67	50	87.72	88	90.72	
Do you use hand gloves during dental procedures?	No	3	1.33	0	0.00	0	0.00	0.355, ns
	Yes	222	98.67	57	100.00	97	100.00	

Do you use eyewear?	No	103	45.78	17	29.82	32	32.99	0.023*, sig
	Yes	122	54.22	40	70.18	65	67.01	
Have you been vaccinated against hepatitis B vaccination?	No	73	32.44	0	0.00	5	5.15	0.001*, sig
	Yes	152	67.56	57	100.00	92	94.85	
Does your setup have proper healthcare waste management	No	9	4.00	0	0.00	5	5.15	0.243, ns
	Yes	216	96.00	57	100.00	92	94.85	
Do you follow adequate protocol after needle stick injury	No	19	8.44	0	0.00	9	9.28	0.078, ns
	Yes	206	91.56	57	100.00	90	92.78	
Do you use protection barrier while taking X-rays	No	122	54.22	6	10.53	28	28.87	0.001*, sig
	Yes	103	45.78	51	89.47	69	71.13	
Do you use devices to measure radiation exposure	No	180	80.00	35	61.40	63	64.95	0.001*, sig
	Yes	45	20.00	22	38.60	34	35.05	

Chi-square test, level of significance set at $p < 0.05$
Ns: non-significant, *sig: significant

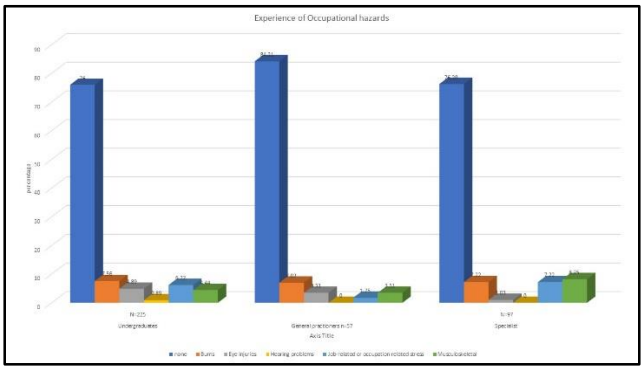

Figure 1: Experience of occupational hazards by dental students and dental professionals

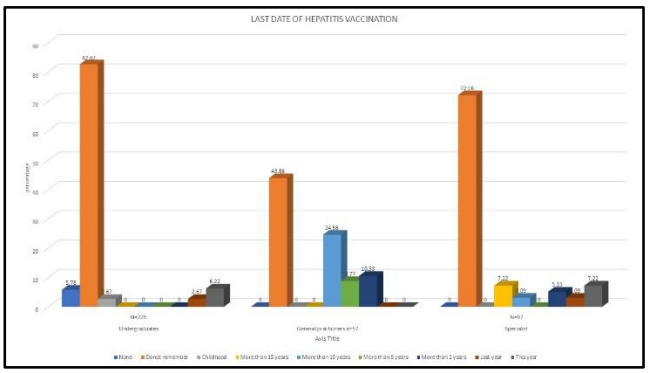

Figure 2: Last date of hepatitis B vaccination record for dental students and dental professionals

4. Discussion

The present survey was conducted on dental students exposed to a clinical environment in one institute and also private practitioners in Faridabad city. The gender distribution revealed that females are more into this occupation. The reason may be that it is considered a prestigious yet safe profession for females. According to a national survey, between 2010 and 2016, the proportion of women working in dentistry increased from 24.5% to 29.8%,[10] hence justifies more female ratio.

Latex allergy was found to be more prevalent in practicing dentists similar to a study by Moodley et al.[11] Another study by Ayatollahi et al.[12] revealed similar results that latex gloves use presented the highest skin allergic reaction. Dentistry is an occupation that necessitates frequent hand washing and hand rubbing with alcohol-containing sanitizers. It leads to the development of break up in the skin barrier which leads to more prone to skin reaction towards powder present in gloves.[13] Previously mercury exposure was more prevalent among the hazards from aerosols as found in a study by Ramaswamy et al in 2020[14] but nowadays amalgam is not the choice of material for restoration as more aesthetic materials are preferred. This is still a concern, especially for dental students as mercury handling is a part of their curricula in endodontics so proper handling of mercury disposal should be inculcated in clinical setup for students.

Dentists handle sharps like needles, burs, scalpels, explorers, probes, etc in every specialty. Any kind of percutaneous injury while working on an infected patient can lead to a high risk of several contagious and fatal diseases. In one of the studies in India, more than 70% of the studied population experienced a sharp injury.[9] Similar results were reflected in a study which was conducted in Karnataka.[15] On assessment of sharp injury, although the reported incidence of sharp injuries was less, the incidence of needle prick injuries was high compared to other sharps in our study. The reason for this may be that nowadays, institution accreditation policies require detailed and long-term follow-up of the patient and clinician. Also, students or clinicians might not want to take the preventive medicines required for these protocols so they don't report minute sharp injuries. Burns were found to be prevalent in our cross-sectional survey compared to noise, Musculoskeletal problems, eye injuries, and hearing problems. Musculoskeletal problems were encountered more by specialists and general practitioners. The explanation for the same lies in more working hours as compared to dental students. MSP was found to be 39.8% in another study conducted in India.[11] In another study conducted in Rajasthan, India, a high correlation was found between posture and MSP.[16] The principles of ergonomics in the prevention of MSP should be

included in practice. Also, in institutes the work culture is shifted to research which results in more sitting in front of screens like laptops, etc, this may be one of the reasons for MSP. Stress due to occupation is also found in undergraduates because they do the treatment procedure for the first time in patients after pre-clinical, and also, meeting with patients with different psychology can lead to anxiety. The results were similar to another literature, which also assessed the psychological hazards most common in students in one of the Chennai institutions.[17] Psychological counseling should be a part of curricula to address such anxieties.

Immunization against hepatitis B virus was obtained by most of the specialists and private practitioners as compared to undergraduates. The results reflect more awareness about protection against contagious diseases. Undergraduates should also be motivated to get the vaccination done and medical camps should be organized in institutes for vaccination. Also, policies should be made for practicing dentists to be cautious about booster doses at regular time intervals.

Although the knowledge of personal protection was high among dental students as well as professionals, there was high awareness at the undergraduate level about personal protection, Similar results were found in a study by Bhuvaneshwari et al.[18] conducted in Odissa and also by Sheikh et al.[19] in Chennai. This revealed that institutes are particular about personal protection while doing patients for dental students. Instead, students were less aware of radiation exposure prevention than specialists and practitioners. The reason may be due to differences in training and institutional practice ethics. Hence, more emphasis should be placed on radiation exposure prevention for students, and comparisons among different institutions should be carried out in future studies to identify the institutions that are lacking. For proper waste disposal and infection control procedures, most of the studied population agreed that they follow proper guidelines.

Since the cross-sectional survey was conducted in a limited population. Hence results can't be implied on a large population. Since the questionnaire included self-reported data, the chances of false positive results are there as dentists are aware of the ideal protocols to be followed. This study included the population from the Faridabad region, so selection bias may occur, and moreover, the results cannot be generalized. Other questions including awareness against noise-induced hazards and vaccination other than hepatitis B along with physical examination also should be prosecuted.

5. Conclusion

Within the limitations of the present study, the conclusion was that females are more enrolled in the dental profession. Prevention of any sharp injury should be reinforced in students and dental professionals. Dental students and practicing dentists knew of personal protection and followed the guidelines adequately. Although more awareness and protection were required for radiation exposure. Workshops and seminars should be arranged at the institutional level for the importance of booster doses of vaccination acquired for general practitioners. Prevention of MSP with the incorporation of ergonomics in dentistry was required more for specialists and private practitioners. Dental education policies should be modified considering the negligence of vaccination and radiation exposure in students.

6. Conflict of Interest

None.

7. Funding

None.

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