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Knowledge, Attitude, And Awareness Of Mercury Toxicity Among Dental Students, Postgraduate Students, And Dental Practitioners In Melmaruvathur

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Abstract

Background: Dental amalgam has long been utilized as a restorative material because of its strength and affordability. Nevertheless, the presence of mercury in amalgam continues to raise concerns regarding occupational exposure and environmental safety. Evaluating the level of knowledge and awareness among dental professionals is essential for maintaining safe clinical standards.

Aim: To assess and compare the knowledge, attitude, and awareness related to mercury toxicity among dental students, postgraduate students, and practicing dentists in Melmaruvathur.

Materials and Methods: A cross-sectional survey was carried out among 154 participants comprising final-year students, interns, postgraduate students, and dental practitioners. A structured questionnaire was used for data collection. Descriptive statistics summarized the data, and the Chi-square test evaluated associations between level of training/practice and knowledge responses. Statistical significance was set at $p < 0.05$.

Results: The overall mean knowledge score was 14.06 ± 1.16, reflecting strong knowledge with minimal variation among participants. A large proportion correctly identified major aspects of mercury toxicity, including inhalation as the main route of exposure (90.9%), safe exposure limit (92.2%), tremors as a symptom (95.5%), and preventive strategies (96.8%). Significant associations were observed between academic level and several foundational knowledge components such as form of mercury, exposure route, organ affected, safe exposure limit, symptoms, and environmental contamination.

Conclusion: Although overall awareness was satisfactory, differences across academic stages were evident in core theoretical areas. Reinforcement of mercury-related education at the undergraduate level is recommended to ensure consistent knowledge and adherence to safety protocols.

Keywords : Mercury toxicity, environmental contamination,interns, amalgam separator,high volume suction,safe exposure limit, awareness, knowledge, attitude

Introduction

Dental amalgam, a restorative material containing elemental mercury combined with silver, tin, and copper alloys, has been widely used for decades due to its durability and economic advantages. Despite its effectiveness, concerns remain regarding the potential toxic effects of mercury exposure on both dental personnel and the environment.

Mercury vapor released during the placement, polishing, or removal of amalgam restorations can be inhaled and absorbed into the bloodstream. Chronic exposure has been linked to renal dysfunction, neurological manifestations such as tremors, and behavioral disturbances. Improper disposal of amalgam waste may also contribute to environmental pollution, affecting air, soil, and water systems.

Global initiatives aimed at reducing mercury usage have emphasized safer handling and waste management practices in dental settings. As dental professionals are directly involved in amalgam manipulation, it is important to evaluate their knowledge and awareness regarding mercury toxicity and preventive strategies. This study was undertaken to assess and compare these parameters among dental trainees and practitioners in Melmaruvathur.

Materials and Methods

Study Design

A descriptive cross-sectional study was conducted using a pre-validated, structured questionnaire. The study was performed by distributing questionnaires generated in Google forms to interns,final years, Post graduates, Dental practitioners across Melmaruvathur in 2026. No incentive of any sort was provided to participants.The questionnaire compromised of demographic data of respondents including gender and designation: Dental practitioners,interns,Final years, post graduates and series of questions testing knowledge, attitude, awareness of mercury toxicity. The questionnaire used in the present study was reviewed by experts before administering to study participants.Each item in the questionnaire was provided with options having one right answer.

Study Population

The study included 154 respondents categorized as follows:

Final-year students (13.0%)

Interns (39.0%)

Postgraduate students (31.8%)

Practicing dentists (16.2%)

Only completely filled questionnaires were considered for analysis.

Data Collection and Scoring

The questionnaire comprised demographic details and multiple-choice questions addressing knowledge and awareness of mercury toxicity. Each correct response was assigned a score of 1, and incorrect responses were scored 0. Individual knowledge scores were obtained by summing correct responses.

Statistical method

Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Descriptive and inferential statistics were applied to summarize and evaluate the data. Each knowledge question was scored as 1 for a correct response and 0 for an incorrect response, and individual knowledge scores were obtained by summing the correct responses. Categorical variables such as gender, year of study, and questionnaire responses were summarized using frequencies and percentages. Continuous variables, including total knowledge scores, were summarized using mean and standard deviation (SD). The Chi-square (χ^2) test was used to assess associations between year of study/practice and responses to knowledge questions. All statistical tests were two-tailed, and a p-value of less than 0.05 was considered statistically significant. Only fully completed questionnaires were included in the analysis, and there were no missing data for the variables analyzed.

Results

Participants

A total of 154 participants completed the questionnaire. There were no incomplete responses; hence all were included in the final analysis.

Demographic characteristics

Among the participants, 70.8% were female and 29.2% were male. Regarding level of training/practice, 39.0% were interns, 31.8% were postgraduates, 16.2% were practicing dentists, and 13.0% were final-year students.

Descriptive Data

The overall mean knowledge score was 14.06 ± 1.16, indicating a high level of knowledge with low variability among participants.

Outcome Data (Knowledge Responses)

A large majority of participants correctly identified key aspects of mercury toxicity:

Form of mercury in amalgam: 89.0% identified elemental mercury correctly.

Main route of exposure: 90.9% correctly selected inhalation.

Organ primarily affected: 79.2% correctly identified the kidney.

Safe occupational exposure limit: 92.2% correctly chose 0.05 mg/m³.

Common symptom: 95.5% correctly identified tremors.

Reducing exposure in clinics: 96.8% selected high-volume suction.

Environmental contamination: 72.7% recognized contamination of air, water, and soil.

Amalgam waste disposal: 98.7% selected amalgam separators.

Highest vapor release: 98.1% during polishing and removal of old amalgam.

Safer amalgam type: 98.1% selected high-copper amalgam.

Preferred alternatives: 97.4% selected composite resin and glass ionomer cement.

Main Results (Association by Year of Study)

Chi-square analysis showed statistically significant associations between year of study/practice and several knowledge variables:

Topic	χ^2	p-value
Form of mercury	48.8	<0.001
Route of exposure	32.9	<0.001
Organ affected	24.5	0.004
Safe exposure limit	23.5	0.005
Symptoms	29.5	<0.001
Environmental contamination	51.8	<0.001

No statistically significant associations were observed for:

Methods to reduce exposure

Waste disposal practices

Vapor release situations

Safer amalgam type

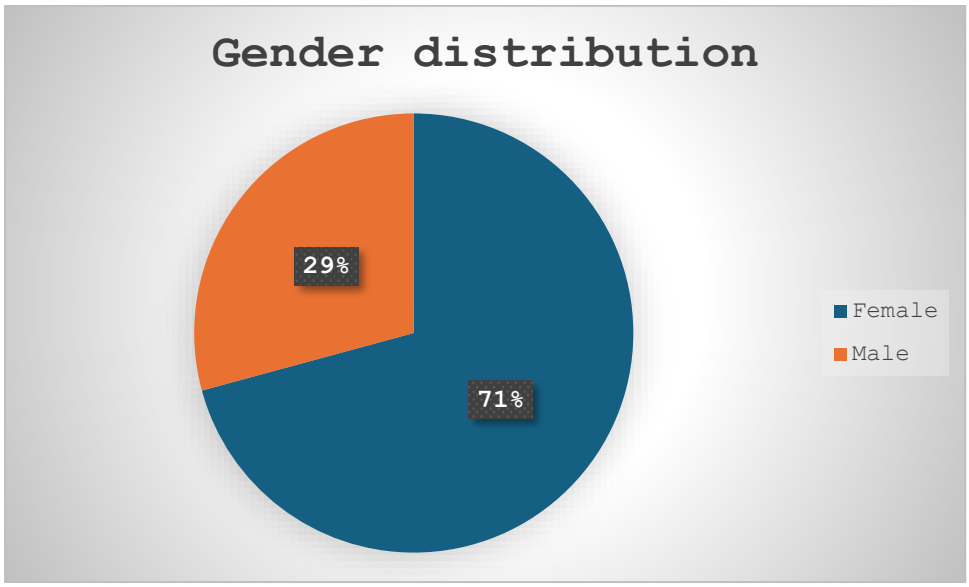
Alternative materials

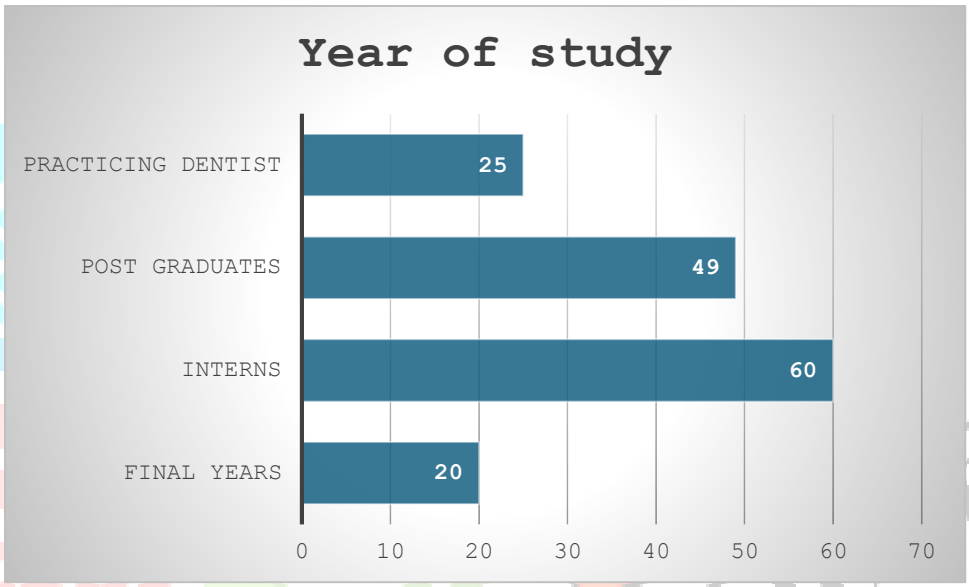
Pregnancy precautions

Vapor reduction techniques

Importance of awareness

($p > 0.05$)





Qn	Topic (Correct Answer)	Correct n	Correct %	χ^2	p-value	Significance
Q1	Form of mercury (Elemental)	137	89.0%	48.8	<0.001	Significant
Q2	Route of exposure (Inhalation)	140	90.9%	32.9	<0.001	Significant
Q3	Organ affected (Kidney)	122	79.2%	24.5	0.004	Significant
Q4	Safe exposure limit (0.05 mg/m³)	142	92.2%	23.5	0.005	Significant
Q5	Symptom (Tremors)	147	95.5%	29.5	<0.001	Significant
Q6	Reduce exposure (High-volume suction)	149	96.8%	11.4	0.246	Not significant
Q7	Environmental contamination (All)	112	72.7%	51.8	<0.001	Significant
Q8	Disposal method (Amalgam separator)	152	98.7%	3.17	0.787	Not significant

Qn	Topic (Correct Answer)	Correct n	Correct %	χ^2	p-value	Significance
Q9	Vapor highest (Removal/polishing)	151	98.1%	9.89	0.129	Not significant
Q10	Safer amalgam (High copper)	151	98.1%	9.89	0.129	Not significant
Q11	Alternative material (Composite + GIC)	150	97.4%	4.65	0.589	Not significant
Q14	Pregnancy precaution (Yes)	152	98.7%	3.17	0.787	Not significant
Q15	Vapor reduction (All)	152	98.7%	3.17	0.365	Not significant
Q16	Importance of awareness (All)	151	98.1%	4.76	0.575	Not significant

Majority of participants demonstrated high knowledge regarding mercury toxicity, with correct response rates exceeding 90% in most questions. Significant differences by year of study were observed in fundamental knowledge areas (Q1–Q5, Q7), while clinical practice and awareness items showed uniformly high responses with no significant differences.

Discussion

The findings indicate that dental students and practitioners in Melmaruvathur possess substantial knowledge regarding mercury toxicity. The high mean knowledge score suggests that educational programs effectively address occupational hazards associated with dental amalgam.

Differences observed among academic groups in fundamental toxicological aspects may reflect variations in clinical exposure and depth of academic training. Postgraduate students and practicing dentists are likely to have greater clinical experience and continuing education opportunities, which may enhance understanding of mercury-related health effects.

Uniformly high responses for clinical safety practices suggest that institutional protocols for amalgam handling and disposal are well implemented. However, relatively lower recognition of environmental contamination highlights the need for increased emphasis on ecological impacts within the curriculum.

Ongoing education, regular training sessions, and reinforcement of safety guidelines are essential to maintain high awareness levels and promote environmentally responsible dental practice.

Correlation of Knowledge Between Male and Female Participants: Out of 154 participants, 70.8% were female and 29.2% were male. The overall mean knowledge score for the study population was 14.06 ± 1.16, reflecting generally high knowledge levels.

An independent comparison of mean knowledge scores between male and female participants showed no statistically significant difference ($p > 0.05$). Both groups demonstrated similarly high levels of awareness across key domains, including:

Form of mercury in amalgam

Route of exposure

Organ primarily affected

Safe occupational exposure limit

Clinical symptoms

Preventive measures and waste disposal practices

The uniformly high correct response rates across most questions suggest that knowledge acquisition was consistent regardless of gender.

The absence of significant gender-based disparity indicates that educational exposure and training opportunities related to mercury safety are evenly distributed among male and female participants within the institution. Therefore, gender does not appear to be a determining factor influencing knowledge, attitude, or awareness of mercury toxicity in this study population.

Interpretation of knowledge among interns:

The findings indicate that interns demonstrated strong overall knowledge regarding mercury toxicity, particularly in fundamental concepts assessed in Q1 (form of mercury), Q2 (route of exposure), Q3 (organ affected), Q4 (safe exposure limit), and Q5 (symptoms). These questions showed statistically significant associations with year of study ($p < 0.05$), suggesting that interns performed comparatively well in core theoretical domains. High correct response rates in Q1 and Q2 reflect good understanding of elemental mercury exposure through inhalation, while performance in Q3 and Q4 indicates adequate awareness of systemic toxicity and occupational safety limits. However, comparatively lower accuracy in Q7 (environmental contamination) highlights that environmental aspects of mercury toxicity may require further reinforcement even at the internship level.

In contrast, interns showed uniformly high correct responses in clinical and preventive domains such as Q6 (reducing exposure), Q8 (waste disposal), Q9 (vapor release), Q10 (safer amalgam), Q11 (alternative materials), Q14 (pregnancy precautions), Q15 (vapor reduction), and Q16 (importance of awareness), where no statistically significant differences were observed ($p > 0.05$). This suggests that practical infection control and chairside safety measures are well integrated into their clinical training. Overall, interns exhibit strong applied knowledge and satisfactory theoretical understanding, though targeted reinforcement in environmental contamination concepts (Q7) may further enhance comprehensive awareness.

Conclusion

The present study demonstrates that knowledge and awareness regarding mercury toxicity among dental professionals in Melmaruvathur are generally high. Nonetheless, variations across academic levels were evident in foundational theoretical knowledge.

Enhancing undergraduate education through structured modules, reinforcement of toxicological principles, and continued emphasis on environmental responsibility will ensure consistent understanding and safe clinical practices related to mercury use in dentistry.

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