Journal of Health, Wellness and Community Research
ISSN: 3007, 0570

OPEN ACCESS

JHWCR

Type: Original Article
Published: 19 December 2025
Volume: III, **Issue**: XVIII
DOI: https://doi.org/10.61919/cdwdtq75

Correspondence
✉ Muhammad Farrukh,
drfarrukhbds@gmail.com

Received 20, 10, 25 **Accepted** 15, 12, 2025

Authors' Contributions
Concept: BA, YA, MF; Design: BA, YA; Data Collection: VM, BA, YA, HV, JK, MF; Analysis: VM; Drafting: VM, BA, YA, JK; Supervision and Critical Review: MF.

Declarations
No funding was received for this study. The authors declare no conflict of interest. The study received ethical approval. All participants provided informed consent.

"Click to Cite"

Changing Trends of Posterior Restoration in Pakistan: A Cross-Sectional Study

Vivek Maheshwari[1], Barkha Alisha[1], Yahya Ahad[2], Hardik Vikrant[1], Javeria Kashif[3], Muhammad Farrukh[4]

1 Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan
2 Khyber College of Dentistry, Peshawar, Pakistan
3 Dow University of Health Sciences, Karachi, Pakistan
4 Margalla Institute of Health Sciences, Rawalpindi, Pakistan

ABSTRACT

Background: *Dental amalgam use is declining globally due to environmental concerns, patient demand for aesthetics, and improvements in adhesive restorative materials, yet its perceived durability continues to influence clinical decision-making.* ***Objective****: To assess current trends in posterior restorative material selection among dental clinicians in Pakistan and to identify factors influencing these choices.* ***Methods****: A cross-sectional observational survey was conducted among undergraduates in clinical years, house officers, postgraduate trainees, and practicing general dentists across Pakistan. A structured questionnaire assessed demographics, knowledge of amalgam-related guidance, attitudes toward amalgam restriction, and clinical practices including material choice for posterior Class II restorations, perceived durability, isolation methods, and recent preference shifts. Data were analyzed using descriptive statistics and inferential tests for categorical distributions with 95% confidence intervals for key proportions.* ***Results****: Among 205 respondents, composite resin was the most commonly reported material for posterior Class II restorations (51.7%; 95% CI 44.9–58.5), followed by dental amalgam (28.8%; 95% CI 23.0–35.3) and glass ionomer cement (11.7%; 95% CI 8.0–16.8). Despite lower use, amalgam was most frequently perceived as the most durable material (73.7%; 95% CI 67.2–79.2). Most clinicians reported shifting from amalgam to composite within the last five years (68.3%). Rubber dam isolation was reported by 50.2% of respondents.* ***Conclusion****: Posterior restorative practice in Pakistan is transitioning toward composite resin use, while durability perceptions remain strongly in favor of amalgam, supporting the need for targeted training in adhesive techniques, isolation, and context-sensitive policies aligned with mercury phase-down goals*

Keywords
Dental Restorative Materials; Composite Resin; Dental Amalgam; Posterior Teeth Restoration; Material Preference; Pakistan

INTRODUCTION

Dental amalgam has served as a mainstay direct restorative material for posterior teeth for more than a century because it is comparatively inexpensive, tolerant to less-than-ideal moisture control, and clinically durable under high occlusal load, particularly in Class I and II restorations (1). Nevertheless, the contemporary restorative landscape is undergoing a sustained transition away from amalgam, driven by a convergence of environmental stewardship, evolving patient expectations for tooth-coloured outcomes, and rapid advances in adhesive and resin-based restorative systems that have expanded the indications for posterior composites (2,3). Internationally, this transition has been further accelerated by mercury phase-down initiatives that position dental amalgam as a modifiable source of anthropogenic mercury exposure at the population level, prompting health systems and professional bodies to re-evaluate its routine use and to strengthen waste-management practices where amalgam remains clinically necessary (2,3).

Although the toxicological risk of set amalgam to individual patients is often framed as low in routine clinical contexts, the environmental externalities associated with mercury-containing waste—particularly from separator non-use, informal disposal pathways, and inadequate segregation of clinical effluent—have become central to policy discussions (2). The Minamata Convention has reinforced this trajectory by promoting a phased reduction in amalgam use through upstream and downstream interventions, including prevention-oriented caries strategies, best environmental practices in dentistry, and promotion of mercury-free alternatives (3). In parallel, resin-based restorative materials have progressed substantially in filler technology, polymer chemistry, and bonding protocols, with growing clinician confidence in posterior performance when appropriate case selection, isolation, and adhesive technique are applied (4). However, the technique sensitivity of composites, concerns regarding marginal integrity in high-caries-risk patients, and the procedural demands for isolation and operator skill continue to influence real-world material selection, contributing to heterogeneity across regions and practice settings (4,5).

Population-level evidence from other health systems illustrates the scale and direction of these shifts. For example, analyses of posterior restorative material choice in insured populations demonstrate an increasing predominance of resin composites over amalgam, reflecting both clinical practice change and patient-facing demand for aesthetics (6). At the same time, multinational survey work indicates that dentists remain attentive to complication profiles associated with direct posterior composites, including postoperative sensitivity, marginal staining, fracture, and recurrent caries, underscoring that the transition is not merely ideological but constrained by perceived and experienced clinical performance (5). Taken

together, the global literature supports a framework in which material choice is influenced by a layered set of determinants: environmental regulation and professional guidance, patient preferences, cost and availability, training and equipment, and clinician judgments regarding longevity under specific oral conditions (2,3,5,6).

Pakistan represents a particularly relevant context in which these competing drivers intersect. Prior Pakistani evidence has documented both the continued clinical reliance on amalgam and substantial gaps in amalgam waste-management knowledge and implementation, highlighting the environmental dimension as a practical challenge rather than a theoretical concern (7). More recent national work has also emphasized that a meaningful proportion of dentists endorse amalgam restriction or phase-out while simultaneously recognizing its durability advantages in posterior stress-bearing restorations, implying a nuanced decision calculus rather than a simple replacement narrative (8). In addition, educational trends within Pakistan suggest that posterior composite teaching and repair strategies have gained prominence in dental curricula, potentially shaping the preferences of younger clinicians who are more frequently trained in contemporary adhesive systems and minimally invasive operative concepts (9). Patient-facing drivers are also increasingly salient: Pakistani data indicate that patient preference often favours tooth-coloured restorations, yet this preference may be anchored more strongly in aesthetic motivations than in awareness of mercury-related environmental considerations, which can influence the demand-side pressure experienced by clinicians (10).

Despite these signals of transition, the national evidence base remains fragmented in two important ways. First, much of the available work has focused either on clinician awareness and attitudes toward amalgam and waste management or on narrow snapshots of practice, limiting an integrated understanding of how knowledge, attitudes, and clinical behaviours cohere within the same sampled population (7,8). Second, Pakistan's substantial diversity in training environments, practice settings, and regional resource constraints raises the possibility of uneven adoption of resin-based posterior restorations, yet comparative descriptions across clinician strata (students, house officers, postgraduates, and general practitioners) are not consistently reported within a single analytic frame (9,10). This knowledge gap constrains the ability of educators, policymakers, and professional bodies to calibrate targeted interventions—whether focused on isolation training, composite handling protocols, caries-risk–based material selection, or environmentally sound waste management—aligned to where practice change is occurring and where it remains stalled (2,7,8).

Accordingly, this cross-sectional study was designed to characterize current posterior restorative material choice among dental clinicians in Pakistan and to identify the principal factors shaping that choice, including perceived durability, clinical workflow considerations, isolation practices, policy perspectives, and the perceived drivers of amalgam decline. The primary objective was to quantify the distribution of restorative materials reported for posterior Class II restorations among Pakistani dental trainees and practitioners, while secondary objectives were to assess clinician knowledge and attitudes regarding amalgam-related guidance and to describe practice patterns relevant to restoration success (e.g., isolation methods and perceived critical procedural steps). The study was guided by the research question: among Pakistani dental clinicians managing posterior restorations, what is the current preference for amalgam versus resin-based and glass ionomer restorations, and which clinician- and practice-related factors are most strongly associated with this preference (2,5,7,8).

MATERIAL AND METHODS

This cross-sectional observational study was conducted to evaluate current trends in posterior restorative material selection among dental clinicians in Pakistan and to examine the clinical, educational, and attitudinal factors influencing these choices. The study design was selected to allow a contemporaneous assessment of knowledge, attitudes, and practices within a heterogeneous dental workforce, consistent with international methodological guidance for descriptive health research. Data were collected from multiple regions of Pakistan through an electronically administered survey between mid-2024 and early 2025, ensuring broad geographic representation across urban and semi-urban clinical settings.

The target population comprised dental undergraduates in their clinical years, house officers, postgraduate residents, and practicing general dentists working in both public and private sectors. Participants were eligible if they were actively involved in clinical dental care or clinical training related to restorative dentistry and provided informed consent to participate. Individuals who declined consent or submitted incomplete questionnaires were excluded from the final analysis. Participants were selected using a non-probability convenience sampling strategy, which was considered appropriate given the exploratory national scope and logistical constraints of recruiting a dispersed professional population.

The required sample size was estimated using the World Health Organization sample size calculator, assuming a 95% confidence level, a 5% margin of error, and an expected prevalence of 50% for posterior composite use to maximize sample size precision (11). This calculation yielded a target sample of 380 participants. Although the achieved sample was smaller, it was deemed sufficient for descriptive and exploratory inferential analyses, given the study's objectives and the diversity of clinician categories represented.

Data were collected using a structured, self-administered questionnaire developed through an extensive review of the existing literature on amalgam use, restorative material selection, and environmental dentistry (7,8). The instrument was informed by previously published and contextually relevant surveys assessing amalgam use and waste management practices among dentists in Pakistan and comparable settings (12,13). The questionnaire was organized into sections capturing demographic and professional characteristics, knowledge of amalgam-related guidelines and potential health or environmental concerns, attitudes toward the phase-down of amalgam and adoption of alternative materials, and self-reported clinical practices related to posterior restorations, including material choice, isolation techniques, and perceived determinants of restoration success.

To enhance content validity and contextual relevance, the draft questionnaire was reviewed by a panel of dental educators and clinicians with expertise in restorative dentistry and public health. A pilot test involving a small group of dental professionals from different training levels was conducted to assess clarity, internal consistency, and face validity, leading to minor refinements in wording and sequencing. The finalized questionnaire was distributed primarily through secure online platforms, including professional networks and institutional channels, with a limited number of paper-based responses collected to facilitate participation in settings with restricted internet access. All participants were informed about the study objectives, voluntary nature of participation, and confidentiality safeguards prior to providing consent.

The primary outcome variable was the self-reported restorative material most commonly used for posterior Class II restorations, categorized as dental amalgam, composite resin, glass ionomer cement, bulk-fill composite, or other materials. Secondary variables included perceived durability of restorative materials, recent changes in material preference, awareness of international and national guidelines related to amalgam use, attitudes

toward regulatory restrictions, and clinical practices such as isolation methods. Demographic and professional variables, including age, level of training, and practice type, were treated as potential explanatory or confounding factors.

Several steps were taken to minimize bias and enhance data integrity. The anonymous nature of the survey was intended to reduce social desirability bias, particularly in responses related to environmental attitudes and guideline compliance. Standardized questions and fixed response options were used to limit measurement variability, while pilot testing helped reduce ambiguity-related misclassification. Although convenience sampling may introduce selection bias, inclusion of participants across multiple professional strata and regions was intended to mitigate this limitation.

Data were entered, cleaned, and analyzed using Statistical Package for the Social Sciences (SPSS) software. Descriptive statistics, including means, frequencies, and percentages, were calculated to summarize participant characteristics and response distributions. Inferential analyses were conducted to explore associations between clinician characteristics and restorative material choice, using appropriate statistical tests for categorical data, with significance assessed at a conventional alpha level. Missing data were handled using complete-case analysis for each variable, and subgroup analyses were performed where relevant to compare responses across training levels and practice settings.

Ethical approval for the study was obtained from the relevant institutional ethical review board prior to data collection, and all procedures were conducted in accordance with established ethical principles for research involving human participants. Participant confidentiality was maintained throughout the study, with data stored securely and accessed only by the research team. Standardized data collection procedures, transparent analytic methods, and clear operational definitions were employed to support reproducibility and facilitate independent verification of the study findings (12,13).

RESULTS

A total of 205 valid responses were analyzed, representing dental undergraduates, house officers, postgraduate residents, and practicing general dentists from multiple regions of Pakistan. General dental practitioners constituted the largest professional group (43.9%), followed by undergraduates (23.9%), house officers (16.6%), and postgraduate trainees (15.6%). Participant ages ranged from 19 to 38 years, with the highest representation observed at 25 years of age.

The study population demonstrated statistically significant heterogeneity in professional composition and age distribution, with general dentists and clinicians aged 25–29 years forming the dominant groups (Table 1). Awareness of amalgam-related guidelines and advancements in restorative materials was consistently high, with more than two-thirds of respondents reporting informed perspectives on both regulatory and technological developments (Table 2).

Table 1. Participant Characteristics and Professional Distribution (n = 205)

Variable	Category	n (%)	p-value*
Professional Status	General Dentists	90 (43.9)	<0.001
	Undergraduates	49 (23.9)	
	House Officers	34 (16.6)	
	Postgraduates	32 (15.6)	
Age Group (years)	≤24	61 (29.8)	0.002
	25–29	88 (42.9)	
	≥30	56 (27.3)	

Table 2. Knowledge and Awareness Regarding Dental Amalgam and Composite Materials

Survey Item	Yes n (%)	No n (%)	p-value†
Belief in evidence of amalgam health/environmental hazards	138 (67.3)	67 (32.7)	<0.001
Awareness of current amalgam guidelines	143 (69.8)	62 (30.2)	<0.001
Awareness of advancements in composite materials	145 (70.7)	60 (29.3)	<0.001

Table 3. Current Posterior Restorative Material Use and Perceived Durability

Variable	Category	n (%)	p-value
Material used in Class II restorations	Composite resin	106 (51.5)	<0.001
	Dental amalgam	59 (28.8)	
	Glass ionomer cement	24 (11.7)	
	Others (bulk-fill/other)	16 (7.8)	
Material perceived as most durable	Dental amalgam	151 (73.7)	<0.001
	Composite resin	39 (19.0)	
	Glass ionomer cement	15 (7.3)	

Table 4. Trends in Material Preference Change and Policy Perspectives

Variable	Category	n (%)	p-value
Change in preferred material (last 5 years)	Shifted amalgam → composite	140 (68.3)	<0.001
	No change	38 (18.5)	
	Shifted to other materials	27 (13.2)	
Preferred regulatory approach	Conditional restriction	108 (52.7)	0.004
	Complete ban	57 (27.8)	
	Retain amalgam as option	40 (19.5)	

Table 5. Clinical Practices Related to Posterior Restorations

Variable	Category	n (%)	p-value
Preferred isolation method	Rubber dam	103 (50.2)	<0.001
	Cotton rolls	89 (43.4)	
	Saliva ejector only	9 (4.3)	
	No isolation	4 (2.0)	
Most critical procedural factor	Cavity design	84 (41.2)	0.018
	Operator skill	66 (32.4)	
	Isolation quality	54 (26.4)	

Composite resin was the most frequently utilized material for posterior Class II restorations, reported by over half of respondents, whereas dental amalgam was selected by fewer than one-third, reflecting a statistically significant departure from historical reliance on amalgam (Table 3). Notably, despite reduced usage, amalgam remained the material most commonly perceived as durable, highlighting a clinically relevant divergence between material preference and durability perception.

Material preference trends revealed that nearly seven in ten clinicians had transitioned from amalgam to composite materials within the past five years, underscoring the momentum of restorative paradigm change in Pakistan (Table 4). Policy attitudes favored conditional restriction rather than outright elimination of amalgam, suggesting pragmatic decision-making aligned with clinical and socioeconomic considerations.

Clinical practice analysis demonstrated that isolation techniques varied substantially, with rubber dam usage reported by half of practitioners, while cavity design emerged as the most frequently cited determinant of restoration success (Table 5). Collectively, these findings delineate a complex interaction between evolving material science, clinician perception, and procedural realities shaping posterior restorative practice in Pakistan.

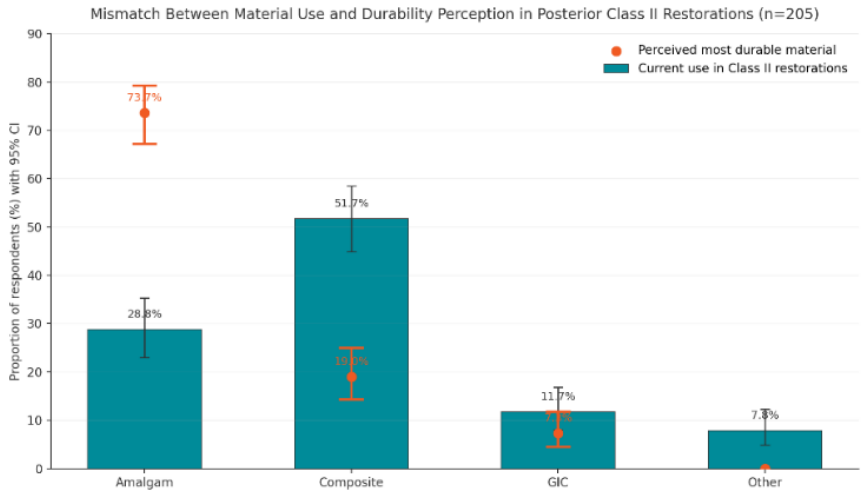

Figure 1 Mismatch between Material Use and Durability Perception in Posterior Class II Restoration (n=205)

In this national sample (n=205), the figure demonstrates a pronounced divergence between reported posterior Class II restorative material use and perceived durability. Composite resin was the most commonly used material (51.7%; 95% CI 44.9–58.5), yet only 19.0% (95% CI 14.2–24.9) selected it as the most durable option, indicating a substantial perception–practice gap. In contrast, dental amalgam was used by 28.8% (95% CI 23.0–35.3) but was overwhelmingly perceived as most durable by 73.7% (95% CI 67.2–79.2), suggesting that durability beliefs remain strongly anchored to amalgam despite declining utilization. Glass ionomer cement showed comparatively low current use (11.7%; 95% CI 8.0–16.8) and low durability preference (7.3%; 95% CI 4.5–11.7), while "other" materials accounted for 7.8% (95% CI 4.9–12.3) of current use with negligible durability endorsement, collectively highlighting that the transition toward adhesive, tooth-colored restorations is occurring even where durability perceptions continue to favour amalgam.

DISCUSSION

The present study provides a comprehensive national snapshot of posterior restorative material selection among dental clinicians in Pakistan, revealing a clear but nuanced transition away from dental amalgam toward resin-based restorative materials. The most salient finding is the coexistence of two seemingly divergent trends: composite resin has emerged as the most frequently used material for posterior Class II restorations, while dental amalgam continues to be overwhelmingly perceived as the most durable option. This discordance between clinical practice and durability perception underscores that the current transition is driven less by a wholesale re-evaluation of material performance and more by external pressures such as aesthetic demand, evolving training paradigms, and environmental considerations, rather than a complete erosion of confidence in amalgam's mechanical longevity (2,5,7).

The observed predominance of composite resin use aligns with international evidence demonstrating a steady decline in amalgam utilization across diverse healthcare systems. Large-scale analyses from the United States and Europe have reported that resin composites now account for the majority of posterior restorations, particularly in insured and private-practice settings, reflecting patient preference for tooth-coloured restorations and increased clinician familiarity with adhesive techniques (6). Similarly, regional surveys from Malaysia and India have documented comparable shifts, especially among younger clinicians who are trained primarily with contemporary composite systems (17,18). The present findings extend this literature by showing that Pakistan follows the same directional trend, albeit with a slower and more heterogeneous adoption, likely reflecting differences in infrastructure, cost constraints, and variability in training quality across institutions (9,14).

Despite reduced clinical use, dental amalgam retained a dominant position in durability perception, with nearly three-quarters of respondents identifying it as the most long-lasting posterior restorative material. This perception is consistent with studies from Egypt, Nigeria, and other low-

and middle-income settings, where clinicians acknowledge amalgam's superior tolerance to moisture, high compressive strength, and predictable performance in high-caries-risk or load-bearing situations . The persistence of this belief suggests that the phase-down of amalgam in Pakistan is not rooted in a consensus that composites are universally superior, but rather in a pragmatic balancing of advantages and limitations. Indeed, more than half of respondents in the present study supported conditional restriction of amalgam use rather than a complete ban, indicating a preference for case-based decision-making that reserves amalgam for specific clinical or socioeconomic contexts, a position also reported in Bangladesh and other resource-constrained health systems (6).

Knowledge and awareness levels among participants were relatively high, with approximately 70% reporting familiarity with amalgam-related guidelines and recent advancements in composite materials. This finding is encouraging and compares favorably with data from Jordan, where similar proportions of dentists were aware of Minamata Convention recommendations (22). However, awareness does not necessarily translate into uniform practice change. Previous Pakistani studies have highlighted significant deficiencies in amalgam waste management and mercury disposal, suggesting that environmental considerations may be acknowledged conceptually but insufficiently operationalized in daily practice (7,20). In this context, the current findings imply that educational interventions must extend beyond theoretical awareness to encompass practical training in environmentally responsible dentistry, including amalgam separation, waste handling, and informed material selection.

Clinical practice patterns identified in this study further contextualize material choice. Only half of respondents reported routine use of rubber dam isolation, despite its well-established role in optimizing composite restoration outcomes. This finding is clinically significant, as inadequate isolation is a known risk factor for postoperative sensitivity, marginal leakage, and restoration failure in resin-based systems (4,6). The fact that cavity design and operator skill were more frequently cited as determinants of success than isolation suggests potential gaps in translating evidence-based restorative principles into routine practice. Similar observations have been reported in surveys of dental education programs in Pakistan, where posterior composite teaching is increasing but hands-on exposure to advanced isolation and bonding protocols remains variable (9).

From a theoretical perspective, the results reflect an ongoing paradigm shift from material-centered dentistry toward a more patient-centered and environmentally conscious model, albeit one constrained by structural realities. While composites offer clear advantages in aesthetics and tooth preservation, concerns regarding technique sensitivity, cost, and long-term performance—particularly in high-risk populations—remain legitimate and influence clinician behavior. Moreover, emerging concerns related to resin-based materials, such as bisphenol exposure and microplastic release, have not been widely explored in the Pakistani context and warrant cautious interpretation of a rapid, uncritical transition away from amalgam (23).

The strengths of this study include its inclusion of multiple professional strata within a single analytic framework and its integrated assessment of knowledge, attitudes, and practices, allowing a more holistic understanding of restorative decision-making than prior single-domain studies. Nevertheless, several limitations must be acknowledged. The cross-sectional design precludes causal inference, and the use of non-probability convenience sampling may limit generalizability, particularly to rural or underserved regions. The achieved sample size was smaller than the calculated target, which may reduce statistical power for subgroup comparisons. In addition, reliance on self-reported practices introduces the possibility of recall and social desirability bias. These limitations suggest that the findings should be interpreted as indicative rather than definitive of national practice patterns.

Future research should build on these findings through longitudinal and mixed-methods approaches that link reported material preferences to clinical outcomes, cost-effectiveness, and patient satisfaction. Prospective cohort studies comparing the survival and complication profiles of posterior composites and amalgam under real-world Pakistani practice conditions would be particularly valuable. In parallel, policy-oriented research evaluating the feasibility of phased amalgam restriction in public-sector dentistry, alongside investments in training and infrastructure, could inform evidence-based implementation of international environmental commitments. Together, such efforts would support a balanced transition that safeguards clinical effectiveness, patient equity, and environmental responsibility within Pakistan's evolving dental care system.

CONCLUSION

In conclusion, this national cross-sectional study demonstrates a clear shift in posterior restorative practices among dental clinicians in Pakistan from dental amalgam toward resin-based materials, particularly composite resins, while simultaneously revealing that amalgam continues to be regarded as the most durable restorative option for posterior teeth. This divergence between material utilization and durability perception reflects a practice environment shaped by aesthetic demand, evolving educational exposure, and environmental considerations rather than a complete loss of confidence in amalgam's clinical performance. The findings highlight important implications for human oral healthcare, emphasizing the need for balanced, evidence-informed material selection that accounts for caries risk, operator skill, isolation capability, and patient socioeconomic context. Strengthening undergraduate and continuing professional education in adhesive dentistry, improving access to isolation aids, and developing context-sensitive national policies aligned with international mercury phase-down initiatives may facilitate a safer and more effective transition toward contemporary restorative care while preserving clinical outcomes and equity in patient management.

REFERENCES

1. Nayab T, Atif M, Ayub U, Bajwa SJ, Khan MA, Babar BZ, et al. Attitudes and Knowledge of Dentists in Pakistan Regarding the Use of Dental Amalgam as a Restorative Material. Pak J Med Health Sci. 2022;16(2):102.
2. World Health Organization; United Nations Environment Programme. Promoting the Phase Down of Dental Amalgam in Developing Countries. Geneva: WHO; 2014.
3. Kisumbi BK, Osiro OA, Gathece LW, Maina SW. Dental Amalgam Phase-Down—Status, Alternatives, Strategies and Preparedness for Implementation: A Review. Int J Dent. 2025;2025:6688410. doi:10.1155/2025/6688410.
4. Lehmann A, Nijakowski K, Jankowski J, Donnermeyer D, Palma PJ, Drobac M, et al. Awareness of Possible Complications Associated With Direct Composite Restorations: A Multinational Survey Among Dentists From 13 Countries With Meta-Analysis. J Dent. 2024;145:105009.
5. Coelho A, Vilhena L, Antunes M, Amaro I, Paula A, Marto CM, et al. Effect of Different Cavity Disinfectants on Adhesion to Dentin of Permanent Teeth. J Funct Biomater. 2022;13(4):209.
6. Estrich CG, Eldridge LA, Lipman RD, Araujo MW. Posterior Dental Restoration Material Choices in Privately Insured People in the United States, 2017 Through 2019. J Am Dent Assoc. 2023;154(5):393–402.

7. Mumtaz R, Khan AA, Noor N, Humayun S. Amalgam Use and Waste Management by Pakistani Dentists: An Environmental Perspective. East Mediterr Health J. 2010;16(3):334–339.
8. Gul S, Khan AA, Qureshi F, et al. Amalgam Phase-Out, an Environmental Safety Concern: A Cross-Sectional Study Among General Dental Practitioners. East Mediterr Health J. 2022;28(1):69–73.
9. Fareed MA, Bashir AF, Yousaf U, Baig QA, Jatala UW, Zafar MS. Trends in Resin Composite Restoration Repair Teaching in Dental Colleges in Pakistan. Eur J Gen Dent. 2021;10(1):14–18.
10. Malik QUA, Maqbool H, Ullah S, Ali A, Elahi A, Khan H. Dentists' and Patients' Perception on the Choice Between Composite and Amalgam Restoration in Khyber Pakhtunkhwa, Pakistan. J Shifa Tameer-e-Millat Univ. 2025;8(1):27–31.
11. World Health Organization. Sample Size Determination in Health Studies: A Practical Manual. Geneva: WHO; 1991.
12. Danaei M, Karimzadeh P, Momeni M, Palenik CJ, Nayebi M, Keshavarzi V, Askarian M. The Management of Dental Waste in Dental Offices and Clinics in Shiraz, Southern Iran. Int J Occup Environ Med. 2014;5(1):18–23.
13. Khalaf ME, Alomari QD, Omar R. Factors Relating to Usage Patterns of Amalgam and Resin Composite for Posterior Restorations—A Prospective Analysis. J Dent. 2014;42(7):785–792.
14. Hassan AM, El-Nour AH, Mahmoud K. Clinical Evaluation and Durability Perceptions of Dental Amalgam and Modern Composites Among Egyptian Dentists. Dent Mater J. 2022;41(5):103123.
15. Eze C, Nwakonobi C, Okeke K. Evaluation of Posterior Restorative Material Preferences Among Nigerian Dental Practitioners. Afr J Oral Health. 2021;10(4):215–221.
16. Rahman MM, Chowdhury F, Karim M. Amalgam Use and Its Alternatives in Bangladesh: Economic and Clinical Perspectives. Bangladesh Dent J. 2020;36(1):21–27.
17. Khalid R, Noor S, Rahman A. Changing Trends in Restorative Material Selection Among Malaysian Dental Practitioners. Asian J Dent Sci. 2022;15(2):45–51.
18. Sharma P, Gupta V. A Survey on the Choice of Restorative Materials for Posterior Teeth Among Indian Dental Practitioners. J Conserv Dent. 2021;24(3):255–261.
19. Widström E, Eaton KA, Luciak-Donsberger C. Changes in Dental Amalgam Use in the Nordic Countries Following the Minamata Convention. Community Dent Health. 2020;37(3):191–197.
20. Khan S, Khalid N, Bajwa O, Qamar T, Kazmi A, Tariq A. Amalgam Phase-Out, an Environmental Safety Concern: A Cross-Sectional Study Among General Dental Practitioners in Pakistan. East Mediterr Health J. 2022;28(1):69–73.
21. Al-Omari FA, Al-Azzam M, Al-Abbadi R. Awareness and Implementation of Minamata Convention Recommendations on Dental Amalgam Use Among Jordanian Dentists. Int J Dent. 2021;2021:1–8.
22. Tran H, Nguyen L, Pham T. Awareness of Mercury-Free Restorative Dentistry Among Rural Southeast Asian Dentists. Int J Environ Res Public Health. 2019;16(23):4627.
23. Anas M, Iqbal J, Sultan MU, Ullah I. Silver Diamine Fluoride in Caries Management: A Paradigm Shift in Paediatric Dentistry. Eur Arch Paediatr Dent. 2025 Aug. doi:10.1007/s40368-024-00997-1.