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

OPEN ACCESS

JHWCR

Type: Original Article
Published: 25 December 2025
Volume: III, **Issue**: XVIII
DOI: https://doi.org/10.61919/sdvc9507

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Received 21, 10, 25 **Accepted** 22, 12, 2025

Authors' Contributions
Concept: MU, AZ, MA; Design: MU, AZ, MA; Data Collection: MU, AZ, MA, MM, SA; Analysis: AZ; Drafting: MU, SA, MA; Supervision and critical revision: 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.

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Cross-Sectional Evaluation of Knowledge, Awareness and Perception of Laser Dentistry in Undergraduate Dental Students and Dental Professionals of Pakistan

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ABSTRACT

***Background**: Laser technology has gained increasing relevance in modern dentistry due to its precision, minimally invasive nature, and favourable patient outcomes; however, its routine adoption in developing countries remains limited. **Objective**: To evaluate the level of knowledge, awareness, and perception of laser dentistry among undergraduate dental students and dental professionals in Pakistan and to identify perceived barriers to its clinical implementation. **Methods**: A descriptive cross-sectional survey was conducted among 263 dental students and practitioners across Pakistan using a structured, self-administered online questionnaire. Data on demographics, knowledge, perceptions, and perceived barriers related to laser dentistry were collected and analysed using descriptive and inferential statistics. **Results**: Although 61.6% of participants reported awareness of laser applications in dentistry, only 25.1% had practical experience. Most respondents perceived laser dentistry as providing greater precision (87.8%), patient comfort (85.2%), and improved treatment quality (89.4%). Dental professionals demonstrated significantly higher awareness and usage compared with students. High equipment cost (78.0%) and lack of training opportunities (57.4%) were the most commonly reported barriers. **Conclusion**: While attitudes toward laser dentistry among dental trainees and professionals in Pakistan are highly positive, limited training exposure and structural constraints restrict its widespread clinical adoption. Strengthening curricular integration and expanding accessible training opportunities may enhance effective implementation of laser-assisted dental care.*

Keywords
Laser dentistry; Knowledge; Awareness; Perception; Dental education

INTRODUCTION

The integration of laser technology into contemporary dental practice has progressively expanded over the past several decades, driven by advances in photonics, tissue–laser interaction science, and clinical instrumentation. Dental lasers are now employed across a wide range of specialties, including operative dentistry, periodontology, pediatric dentistry, prosthodontics, oral and maxillofacial surgery, and endodontics, where they are used for procedures involving both soft and hard tissues(1). Compared with conventional mechanical instruments, laser-assisted techniques are associated with improved procedural precision, reduced intraoperative bleeding, selective tissue ablation, diminished postoperative discomfort, and, in selected indications, reduced reliance on local anesthesia(2,3). These advantages have positioned laser dentistry as an important adjunct rather than a replacement for conventional dental care, particularly in minimally invasive and patient-centred treatment approaches(4).

Despite these documented benefits, the translation of laser technology from controlled clinical settings into routine dental practice has been uneven. Global surveys consistently report moderate theoretical awareness of dental lasers among students and practitioners, coupled with limited understanding of laser physics, wavelength-specific applications, and safety considerations, and an even more pronounced lack of hands-on clinical experience(5,6). This disparity between conceptual familiarity and practical competence suggests that exposure to laser dentistry remains insufficient within undergraduate curricula and early postgraduate training, even in settings where the technology is available. Consequently, many practitioners continue to rely predominantly on conventional techniques despite recognising the potential advantages of laser-assisted procedures(7).

These challenges are more pronounced in low- and middle-income countries, where structural, educational, and economic constraints further limit the adoption of advanced dental technologies. In Pakistan, available evidence indicates that routine use of dental lasers remains confined to a small number of tertiary centres and urban practices, with limited penetration into undergraduate teaching hospitals and peripheral clinical settings(8). Previous local studies have highlighted gaps in awareness regarding laser indications, safety protocols, and clinical applicability, as well as

substantial barriers related to equipment cost, lack of formal training pathways, and insufficient curricular emphasis during dental education(9,10). However, much of the existing literature focuses narrowly on specific procedures or practitioner subgroups, providing an incomplete picture of how knowledge, awareness, and perceptions of laser dentistry vary across different stages of professional development.

Understanding these dimensions is particularly relevant in a healthcare system where the dental workforce is predominantly young and early-career, and where curricular reform and continuing professional development initiatives are actively being debated. Without robust data describing current levels of knowledge, perceived utility, and perceived barriers among both undergraduate dental students and practicing dental professionals, efforts to design effective educational interventions and policy responses remain poorly informed. Moreover, few studies have simultaneously examined cognitive awareness, attitudinal perceptions, and experiential exposure within a single nationally distributed cohort, limiting the ability to contextualise laser dentistry adoption within broader patterns of professional training and practice.

The present cross-sectional study was therefore undertaken to evaluate the level of knowledge, awareness, and perception of laser dentistry among undergraduate dental students and dental professionals in Pakistan, and to identify perceived barriers and facilitators influencing its clinical adoption. By capturing data across multiple professional categories and practice settings, this study aims to address a critical evidence gap and provide an empirical basis for strengthening dental education, training frameworks, and institutional support related to laser dentistry.

MATERIALS AND METHODS

This cross-sectional observational study was conducted to assess knowledge, awareness, and perceptions of laser dentistry among undergraduate dental students and practicing dental professionals in Pakistan. The study design was selected to provide a snapshot of current educational exposure, clinical experience, and attitudinal patterns across different stages of dental training and professional practice within a diverse national cohort. Data collection was carried out over a defined period following institutional ethical approval, using a structured, self-administered questionnaire distributed electronically.

Participants were eligible if they were enrolled undergraduate dental students, house officers, general dental practitioners, postgraduate trainees, or consultants currently practicing or training in Pakistan. Individuals not affiliated with dental education or clinical dental practice were excluded. A non-probability purposive sampling strategy was employed to ensure representation from a range of academic and professional categories, reflecting the heterogeneity of the national dental workforce. Recruitment was facilitated through professional dental networks, institutional communication channels, and social media platforms commonly accessed by dental students and practitioners. Participation was voluntary, and electronic informed consent was obtained from all respondents prior to survey initiation.

The study instrument consisted of a structured questionnaire developed following a review of relevant published literature addressing laser dentistry education, awareness, and clinical application(11–14). The questionnaire was designed in clear, accessible language and organised into four interconnected domains. The first domain captured demographic and professional characteristics, including age, gender, professional designation, years of clinical experience, and primary practice sector. The second domain assessed knowledge and awareness related to laser dentistry, including familiarity with laser applications, types of dental lasers, wavelength considerations, and prior exposure or use in clinical practice. The third domain evaluated perceptions and attitudes toward laser-assisted dental procedures, encompassing perceived effectiveness, safety, patient comfort, precision, cost-effectiveness, and regulatory oversight. The final domain explored perceived barriers and advantages associated with the adoption of laser dentistry within the Pakistani context.

To enhance content validity and clarity, the draft questionnaire was reviewed by experienced dental educators and clinicians, and revisions were made based on expert feedback. A pilot test involving a small group of participants from different professional categories was conducted to assess comprehensibility and flow, after which minor refinements were incorporated. The final version of the questionnaire was administered electronically using a secure online platform, with measures implemented to prevent duplicate responses. The survey remained open for a predefined duration, during which periodic reminders were circulated to improve response rates.

Collected data were exported for statistical analysis using IBM SPSS Statistics version 27.0. Descriptive statistics were computed to summarise demographic variables and key outcome measures, with results expressed as frequencies, percentages, means, and standard deviations as appropriate. Knowledge, awareness, and perception variables were operationalised based on predefined questionnaire responses. Where applicable, subgroup analyses were planned to explore variations across professional designation and experience levels. Missing data were handled using complete-case analysis to maintain analytic transparency. Measures to minimise bias included anonymous data collection, neutral question phrasing, and restriction of access to raw data to the research team.

Ethical approval for the study was obtained from the Research Ethics and Review Board of the PRIDE institution under reference number PRIDE/ERB/2025/024. All procedures were conducted in accordance with relevant ethical standards, and respondent confidentiality was strictly maintained. No personally identifiable information was collected, and all data were stored securely and used exclusively for academic research purposes, ensuring reproducibility and data integrity throughout the study process.

RESULTS

A total of 263 participants were included in the final analysis. Demographic and professional characteristics are summarised in Table 1. The cohort was predominantly female (72.6%), with most participants aged between 20 and 25 years (62.0%). Undergraduate dental students constituted the largest professional group (54.4%), followed by general dental practitioners (25.1%) and house officers (12.9%). The majority of respondents reported limited professional experience, with 66.2% having worked for one year or less. More than half of the participants were affiliated with the public sector (56.3%), while approximately one-third reported working across both public and private sectors. Knowledge and awareness regarding laser dentistry are presented in Table 2. Overall, 61.6% of respondents reported awareness of laser use in dentistry, while only 25.1% had ever used lasers in clinical practice. Familiarity with different laser types was reported by 67.3% of participants, whereas awareness of wavelength variations was lower (51.7%). Prior clinical experience with laser dentistry was limited, with nearly two-thirds reporting no experience. When stratified by professional status (students versus dental professionals), awareness of laser applications was significantly higher among professionals (72.4% vs 53.8%, $\chi^2 = 9.84$, $p = 0.002$), as was prior laser use (38.6% vs 14.7%, $\chi^2 = 18.92$, $p < 0.001$). Perceptions toward laser dentistry are summarised in Table 3. Most participants perceived laser-assisted procedures as providing greater patient comfort (85.2%), higher precision (87.8%), and improved treatment quality (89.4%). Belief in reduced need for local anaesthesia was reported by 61.6% of respondents.

Although perceptions were generally positive, only 42.2% considered laser dentistry to be cost-effective. Dental professionals were more likely than students to perceive lasers as clinically effective (58.6% vs 40.6%, p = 0.009) and safe for medically compromised patients (68.1% vs 53.8%, p = 0.021).

Table 1. Demographic and Professional Characteristics of Participants (n = 263)

Variable	Category	n (%)
Gender	Female	191 (72.6)
	Male	72 (27.4)
Age (years)	<20	32 (12.2)
	20–25	163 (62.0)
	25–30	49 (18.6)
	>30	19 (7.2)
Designation	Dental student	143 (54.4)
	House officer	34 (12.9)
	General dentist	66 (25.1)
	Postgraduate trainee	13 (4.9)
	Consultant	7 (2.7)
Work experience	0–1 year	174 (66.2)
	1–3 years	58 (22.1)
	3–5 years	14 (5.3)
	>5 years	17 (6.5)

Table 2. Knowledge and Awareness of Laser Dentistry by Professional Status

Variable	Students n (%)	Professionals n (%)	p-value
Aware of laser use	77 (53.8)	85 (72.4)	0.002
Ever used lasers	21 (14.7)	45 (38.6)	<0.001
Familiar with laser types	86 (60.1)	91 (77.8)	0.004
Aware of wavelength variation	63 (44.1)	73 (62.4)	0.006

Table 3. Perceptions Toward Laser Dentistry by Professional Status

Perception	Students n (%)	Professionals n (%)	p-value
Lasers more effective	58 (40.6)	70 (58.6)	0.009
Reduce need for anaesthesia	78 (54.5)	84 (71.8)	0.006
Safe in medically compromised	77 (53.8)	81 (68.1)	0.021
Greater patient comfort	117 (81.8)	107 (91.5)	0.032
Cost-effective	51 (35.7)	60 (51.3)	0.015

Perceived barriers and advantages of laser dentistry are shown in Table 4. High equipment cost was the most frequently reported barrier (78.0%), followed by lack of training opportunities (57.4%) and limited awareness among dentists (48.7%). The most commonly cited advantages were minimally invasive procedures (41.8%) and improved precision (20.5%). No significant gender-based differences were observed in perceived barriers or advantages (all p > 0.05).

Table 4. Perceived Barriers and Advantages of Laser Dentistry

Category	Item	n (%)
Barriers	High equipment cost	205 (78.0)
	Lack of training	151 (57.4)
	Limited awareness	128 (48.7)
	Low patient demand	101 (38.4)
	Lack of curriculum emphasis	92 (35.0)
Advantages	Minimally invasive	110 (41.8)
	Better precision	54 (20.5)
	Reduced bleeding	38 (14.5)
	Patient comfort	35 (13.3)
	Faster healing	26 (9.9)

DISCUSSION

This cross-sectional study evaluated knowledge, awareness, and perceptions of laser dentistry among undergraduate dental students and dental professionals in Pakistan, revealing a pattern of moderate cognitive awareness, strongly positive attitudes, and limited hands-on clinical exposure. While nearly two-thirds of participants reported awareness of laser applications, only one-quarter had used lasers in practice, underscoring a persistent gap between theoretical familiarity and experiential competence. This discrepancy appears to reflect systemic limitations in structured training opportunities rather than resistance to technological adoption.

Consistent with international literature, dental professionals demonstrated significantly higher levels of awareness and prior laser use compared with undergraduate students, likely reflecting cumulative clinical exposure and access to postgraduate learning environments(15,16). However, even among professionals, reported hands-on experience remained modest, suggesting that postgraduate training alone may be insufficient to ensure procedural competence. Similar findings have been reported in studies from South Asia and the Middle East, where theoretical endorsement of laser dentistry contrasts sharply with limited practical implementation(17,18).

Perceptions toward laser dentistry were overwhelmingly positive, with most respondents associating laser-assisted procedures with improved precision, patient comfort, and overall treatment quality. These perceptions align with clinical evidence demonstrating reduced tissue trauma, enhanced haemostasis, and favourable patient-reported outcomes associated with laser use in selected dental procedures(19,20). Notably, belief in reduced anaesthetic requirements and safety in medically compromised patients was more prevalent among professionals than students, suggesting that clinical context and experiential learning influence risk–benefit appraisal.

Despite favourable attitudes, perceived cost-effectiveness remained low, with fewer than half of participants viewing laser dentistry as economically viable. High equipment cost emerged as the dominant barrier, followed by limited training opportunities and insufficient curricular emphasis. These findings mirror reports from comparable healthcare systems, where financial constraints and lack of institutional support are consistently cited as obstacles to integrating advanced dental technologies(21,22). Importantly, the perception of inadequate curricular emphasis among a substantial proportion of respondents reinforces calls for formal integration of laser dentistry into undergraduate education, rather than reliance on optional workshops or external certification courses.

The present findings must be interpreted in light of certain limitations. The cross-sectional design precludes causal inference, and reliance on self-reported data introduces the possibility of recall and social desirability bias. The use of non-probability sampling may limit generalisability, particularly to practitioners in rural or under-resourced settings. Nevertheless, the inclusion of participants across multiple professional strata and practice sectors strengthens the relevance of the findings and provides a comprehensive overview of current educational and clinical realities (23). Overall, the results suggest that while acceptance of laser dentistry among dental trainees and professionals in Pakistan is high, meaningful adoption is constrained by structural and educational barriers. Addressing these gaps through curriculum reform, accessible hands-on training, and institutional investment may facilitate more equitable and effective integration of laser technology into routine dental practice, aligning professional enthusiasm with practical capability.

CONCLUSION

This study demonstrates that undergraduate dental students and dental professionals in Pakistan exhibit generally positive perceptions toward laser dentistry, recognising its potential advantages in terms of precision, patient comfort, and treatment quality, yet possess only moderate levels of knowledge and limited practical experience. The findings suggest that the gap between favourable attitudes and actual clinical adoption is largely driven by structural barriers, including high equipment costs, inadequate hands-on training opportunities, and insufficient integration of laser dentistry within undergraduate curricula. Addressing these constraints through curriculum reform, accessible training pathways, and institutional support may facilitate more effective translation of laser technology into routine dental practice and better align educational outcomes with contemporary clinical demands.

REFERENCES

1. Walsh LJ. The current status of laser applications in dentistry. Aust Dent J. 2003;48(3):146–155.
2. Lomke MA. Clinical applications of dental lasers. Gen Dent. 2009;57(1):47–59.
3. Mishra MB, Mishra S. Lasers and its clinical applications in dentistry. Int J Dent Clin. 2011;3(4):35–39.
4. Rajan JS, Muhammad UN. Evolution and advancement of lasers in dentistry: a literature review. Int J Oral Health Sci. 2021;11(1):6–14.
5. Al-Jobair A. Dental laser education and knowledge among final year dental students at King Saud University in Riyadh, Saudi Arabia. Saudi J Dent Res. 2014;5(2):98–103.
6. Vasishta A. Awareness of laser dentistry among undergraduate dental students. Biosci Biotechnol Res Commun. 2020;13:338–344.
7. Gupta V, Mishra S, Sangha KS, Rahman W, Goswami V, Thakkar V. Assessment of knowledge and practice of lasers among dental professionals of Central India. J Indian Assoc Public Health Dent. 2022;20(1):100–105.
8. Alam F, Gul K, Shah FA, Yousafzai B, Zohaib M, Rahman FU. Dental practitioner's awareness, knowledge, and attitudes towards the use of laser technology in endodontic disinfection: a cross-sectional study. J Khyber Coll Dent. 2024;14(4):2–8.
9. Hameed F, et al. Educational needs of dental laser as perceived by dental graduates: a survey of knowledge and skill requirements. Acta Sci Dent Sci. 2020;4(8):43–47.
10. Farooq S, Lone N, Sidiq M. Educational needs of dental laser as perceived by dental graduates of Kashmir. SCIREA J Clin Med. 2022;7(2):128–138.
11. Sharma R, Pandit S. Laser technology in dentistry: advancements, applications, and future trends. 2025:22–24.
12. Sachelarie L, Cristea R, Burlui E, Hurjui LL. Laser technology in dentistry: from clinical applications to future innovations. Dent J. 2024;12(12):420.
13. Kishen A. Advanced therapeutic options for endodontic biofilms. Endod Topics. 2010;22(1):99–123.
14. Anitha KP, Anil S. Lasers and their applications in dental practice. Int J Dent Oral Sci. 2020;7(11):936–943.
15. Hameed F, Al I, Shaikh WG, Mazhar L, Hafeez N, Aslam MA, et al. Educational needs of dental laser as perceived by dental graduates: a survey of knowledge and skill requirements. Acta Scientific Dental Sciences. 2020;4(8):43–47. doi:10.31080/ASDS.2020.04.0885. Acta Scientific
16. AlHumaidi MA, AlJahdali SL, AlGab MKM, Alrizqi AA, AlShammeri AN, AlQarni AA. Lasers related knowledge and practices of dentists in Riyadh city: a survey-based study. Annals of Dental Specialty. 2021;9(3). doi:10.51847/oZYea7i8j6. annalsofdentalspecialty.net.in
17. Al-Jobair A. Dental laser education and knowledge among final year dental students at King Saud University in Riyadh, Saudi Arabia. Saudi J Dent Res. 2014;5(2):98–103. ScienceDirect+1
18. Pagare N, Gujar D, Pagare J, Surwade A. Awareness, attitude and practice of dental lasers among periodontal practitioners in Pune Region – a cross-sectional questionnaire-based study. Lasers in Dental Science. 2025;9:42. Springer Nature Link
19. Arat Maden E, Tirnaksiz Müftüoğlu M, Özen B, Altun C. Evaluation of pediatric dentists' knowledge, attitudes, and practices regarding the use of lasers. Lasers Med Sci. 2025;40:356. Springer Nature Link
20. Khorasanchi M, Hoseinzadeh M, Khadem Rezaeian M, Kazemian A, Moradi A, Sarabadani J, et al. The development of a serious game for laser applications in dentistry and the evaluation of dental students' satisfaction. BMC Med Educ. 2024. Springer Nature Link

21. Yadav S, Chaudhry S, Talwar S, Verma M. Knowledge and practices of dental lasers among dental professionals in India: a survey-based study. J Dent Lasers. 2018;12(2):50–55. doi:10.4103/jdl.jdl_2_18. CoLab+1
22. Verma SK, Maheshwari S, Singh RK, Chaudhari PK. Laser in dentistry: an innovative tool in modern dental practice. Natl J Maxillofac Surg. 2012;3(2):124–132. Europe PMC
23. Cobb CM. Lasers in periodontics: a review of the literature. J Periodontol. 2006;77(4):545–564. doi:10.1902/jop.2006.050417