

BRIDGING THE KNOWLEDGE GAP: AWARENESS AND PERCEPTION OF LASER TECHNOLOGY IN PERIODONTICS AMONG DENTAL STUDENTS - A CROSS SECTIONAL STUDY

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DOI: <http://dx.doi.org/10.24327/ijrsr.20251603.0027>

ARTICLE INFO

Article History:

Received 12th February 2025

Received in revised form 24th February 2025

Accepted 18th March 2025

Published online 28th March 2025

Key words:

Lasers in periodontics, dental students, knowledge and awareness, laser education, dental curriculum.

ABSTRACT

Background: Laser technology has emerged as a valuable tool in periodontics, offering precise, efficient, and minimally invasive treatment options. Despite its advantages, limited exposure and training may hinder its adoption in dental practice. This study aims to assess the knowledge and awareness of lasers in periodontics among dental students at various academic levels. **Methods:** A cross-sectional study was conducted among **161 dental students** from various academic years using a **validated questionnaire**. The questionnaire comprised sections on demographic details, awareness of laser applications in periodontics, and knowledge-based questions regarding laser technology. A **stratified random sampling** approach ensured balanced representation across academic levels. The data were analyzed using **descriptive statistics** and the **Chi-square test** to evaluate associations between academic progression and awareness levels. A **p-value ≤ 0.05** was considered statistically significant. **Results:** Findings indicate that knowledge and awareness of laser applications in periodontics significantly increase with academic progression. Interns and final-year students demonstrated the highest level of awareness, while first-year and second-year students exhibited limited knowledge. Exposure to laser procedures and formal training were significantly associated with higher academic levels ($p < 0.05$). Financial constraints and lack of training were identified as major barriers to adopting laser technology. Most interns and final-year students expressed willingness to integrate lasers into their future practice. **Conclusion:** The study highlights the need for early integration of laser education into the dental curriculum to bridge the knowledge gap and enhance confidence in adopting laser technology. Addressing financial and educational barriers through structured training programs may facilitate wider acceptance of laser-based treatments in periodontics.

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INTRODUCTION

Periodontal disease, characterized by the progressive

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destruction of the supporting structures of the teeth, poses a significant public health challenge globally. Traditional treatment modalities, such as scaling and root planing (SRP), aim to mechanically remove plaque and calculus deposits to halt disease progression. However, these conventional approaches may have limitations, including incomplete debridement and patient discomfort. The advent of laser technology has introduced new possibilities in periodontal therapy. Lasers,

an acronym for Light Amplification by Stimulated Emission of Radiation, emit concentrated light energy capable of precise tissue interaction. In periodontics, various laser types, including diode, neodymium-doped yttrium aluminum garnet (Nd:YAG), erbium-doped yttrium aluminum garnet (Er:YAG), and erbium, chromium-doped yttrium, scandium, gallium, and garnet (Er,Cr:YSGG), have been utilized for both soft and hard tissue applications. These applications encompass procedures such as bacterial decontamination, removal of the sulcular epithelium, and osseous surgery.¹Clinical studies have demonstrated that adjunctive use of lasers with SRP can result in improved clinical outcomes. For instance, the diode laser has been shown to promote greater clinical attachment level (CAL) gains at three and six months post-treatment compared to SRP alone.²Similarly, the Er:YAG laser has been reported to effectively remove calculus and reduce subgingival bacteria, leading to significant pocket depth reduction.¹Moreover, lasers offer benefits such as reduced intraoperative bleeding, minimal postoperative discomfort, and enhanced patient acceptance. Despite these advantages, the integration of laser technology into routine periodontal practice is not yet universal. A critical factor influencing this integration is the level of knowledge, attitude, and practice (KAP) among dental professionals, particularly dental students who represent the future workforce. Studies assessing KAP regarding laser use in periodontics have revealed varying levels of awareness and proficiency. For example, a study among dental students highlighted a general awareness of laser applications but identified gaps in comprehensive understanding and practical training.³Similarly, research involving dental professionals indicated a positive attitude towards laser use but underscored the need for formal education and hands-on training to enhance competency.⁴Therefore, it is imperative to assess the current state of knowledge and attitudes towards laser applications among dental students. Such assessments can inform curriculum development, ensuring that emerging dental professionals are well-equipped to incorporate advanced technologies into clinical practice effectively. This study aims to evaluate the awareness, attitudes, and perceived educational needs regarding laser use in periodontics among dental students, thereby contributing to the optimization of dental education and ultimately improving patient care outcomes.

MATERIALS AND METHODS

This cross-sectional study was conducted among 161 dental students enrolled in different academic years, ranging from first-year to internship level. The study population included 83 female students (51.6%) and 78 male students (48.4%), ensuring a balanced gender representation. Participants were selected based on their willingness to participate, and informed consent was obtained before data collection.

A structured, pre-validated questionnaire was designed to assess students' knowledge and awareness of the role of lasers in periodontics. The questionnaire was developed based on a review of existing literature and expert input from periodontology faculty members. The questionnaire consisted of multiple-choice and close-ended questions categorized into two main sections:

1. Awareness-Based Questions: Assessed familiarity with laser use, observation of laser procedures, formal

education on laser dentistry, and knowledge of specific laser treatments in periodontics.

2. Knowledge-Based Questions: Examined the extent of understanding regarding laser applications, benefits, risks, types of lasers used, and the future role of lasers in periodontal practice.

Data Collection Procedure

The questionnaire was distributed among the participants, and responses were collected anonymously. The data included responses regarding whether students had prior exposure to laser procedures, received any formal training, or were familiar with specific laser techniques such as LANAP (Laser-Assisted New Attachment Procedure) and LAPT (Laser-Assisted Periodontal Therapy).

STATISTICAL ANALYSIS

The collected data were statistically analyzed using the Chi-square test to determine significant associations between students' academic levels and their responses. The Chi-square test was applied to identify differences in awareness and knowledge based on year of study. A p-value of ≤ 0.05 was considered statistically significant, indicating that differences in responses across different academic years were unlikely due to chance.

Key Statistical Findings

Awareness of Laser Use in Dentistry

The responses varied significantly across academic levels ($p < 0.05$), with final-year students and interns demonstrating higher awareness than first- and second-year students.

Exposure to Laser Procedures

A statistically significant difference was observed ($p < 0.05$) in students who had seen laser procedures in practice, with higher-year students reporting greater exposure.

Formal Education on Lasers

Interns had received the most formal training, whereas first- and third-year students showed limited or no exposure ($p < 0.05$).

Knowledge of Laser Applications

Awareness of different laser treatments and their benefits was significantly higher in final-year students and interns, while first-year students displayed limited knowledge ($p < 0.05$).

RESULTS

Awareness of Laser Use in Dentistry

A majority of final-year students and interns are aware of laser use in dental practice, while a significant proportion of first-year and second-year students are unaware. This suggests that awareness increases as students progress through their education. (Table 2, Chart 2)

Observing Laser Procedures in Practice

Higher-year students (interns and final-year) have seen laser procedures more frequently than lower-year students. First-year and second-year students mostly have not seen laser procedures, indicating limited early exposure. (Table 2, Chart 2)

Formal Education or Training on Laser Dentistry

Interns (56) have received the most formal training, whereas first-year and third-year students have little to no exposure. This suggests that laser education is introduced in later years of study. (Table 2, Chart 2)

Familiarity with Laser Treatments in Periodontics

The majority of interns and final-year students are familiar with specific laser treatments, particularly LANAP (Laser-Assisted New Attachment Procedure). However, first-year and second-year students are mostly unaware of laser treatments in periodontics. (Table 2, Chart 2)

Understanding of Laser Risks and Limitations

“High cost” was the most commonly identified limitation across all years. Interns and final-year students showed better awareness of laser-related risks such as retinal damage, while lower-year students were less informed. (Table 2, Chart 2)

Use of Hard Tissue Laser for Soft Tissue

A majority of participants, especially interns and final-year students, correctly identified that hard tissue lasers should not be used for soft tissue applications. Uncertainty was higher among lower-year students. (Table 2, Chart 2)

Future of Lasers in Periodontics

Most participants (especially interns and final-year students) believe that lasers will become a standard tool in periodontics. Lower-year students were more uncertain about the future role of lasers. Awareness and knowledge about laser dentistry significantly improve with higher levels of education. Interns and final-year students are the most knowledgeable and experienced with laser procedures, while first- and second-year students have limited awareness. There is a need for early exposure and training in laser dentistry to improve awareness across all study years. (Table 2, Chart 2)

Knowledge of Laser Applications in Periodontics

Final-year students and interns are the most knowledgeable, with most being moderately familiar or somewhat familiar with laser applications. First-year and second-year students have the least knowledge, with many being not familiar at all. Knowledge increases with progression in dental education. (Table 3, Chart 3)

Perceived Benefits of Lasers in Periodontics

Interns (45 responses) recognize “reduced bleeding” as a major benefit, followed by less time taken and less need for anesthesia. First-year and second-year students show a high level of uncertainty, indicating a gap in their understanding. (Table 3, Chart 3)

Uses of Lasers in Periodontics

Interns and final-year students identified “soft tissue curettage” and “gingivectomy & crown lengthening” as common uses. A significant number of first-year and second-year students “don’t know” the uses of lasers, showing a lack of exposure. (Table 3, Chart 3)

Types of Lasers Used in Periodontics

The majority of interns (51 responses) correctly identified that both soft and hard tissue lasers are used. First-year students (11) showed the highest level of uncertainty, again reflecting lower exposure to the topic. (Table 3, Chart 3)

Lasers Replacing Traditional Periodontal Surgery

The majority of final-year students and interns believe lasers cannot completely replace traditional surgical procedures, but some consider the possibility. First-year and second-year students are mostly uncertain, reflecting their limited understanding of the effectiveness of lasers. (Table 3, Chart 3)

Importance of Laser Training for Dental Students

Most interns and final-year students consider laser training as “very important” or “important” for dental education. A few first-year students (4) responded that it is “not important,” showing a lack of awareness. (Table 3, Chart 3)

Future Incorporation of Lasers in Practice

The majority of interns (51 responses) and final-year students (31 responses) are willing to incorporate lasers in their future practice. First-year and second-year students are mostly uncertain, likely due to their limited exposure to laser applications. (Table 3, Chart 3)

Barriers to Adopting Laser Technology in Periodontics

(Not Statistically Significant, $p = .706$) High cost, lack of training, and uncertainty about effectiveness were the most commonly cited barriers across all years. This suggests that while knowledge and exposure increase with study progression, financial and educational barriers remain a concern for all students.

Knowledge about laser applications improves significantly with higher education levels, with interns and final-year students demonstrating the most awareness. First-year and second-year students show a high level of uncertainty, emphasizing the need for early laser education. Most students recognize the benefits of lasers in periodontics, but concerns about cost, training, and effectiveness remain key barriers. Incorporating structured laser training in the curriculum could enhance awareness and confidence in adopting laser technology. (Table 3, Chart 3)

DISCUSSION

This study evaluated the awareness and perception of laser technology in periodontics among dental students at various academic levels. The findings reveal a progressive increase in knowledge and awareness of laser applications in periodontics as students advance in their education, with final-year students and interns exhibiting the highest levels of awareness. This trend aligns with previous research indicating that dental students’ understanding of laser technology improves with increased exposure and training during their academic journey.⁵ Despite the observed increase in awareness among senior students, a significant portion of respondents across all levels reported inadequate knowledge about laser applications in periodontics. This insufficiency underscores the need for enhanced educational strategies to integrate laser technology into the dental curriculum effectively. Studies have shown that incorporating comprehensive theoretical and practical laser education can significantly improve students’ competence and confidence in utilizing this technology in clinical settings.⁶ The study also identified several barriers to the adoption of laser technology in periodontics. High equipment costs emerged as a significant deterrent, consistent with existing literature highlighting financial constraints as a primary obstacle to widespread laser utilization in dental practices. The purchase of dental lasers, especially high-performance ones such as erbium or carbon dioxide lasers, can range from USD 10,000 to 80,000, depending on the type and functionality, making

them less accessible to smaller practices.^{5,7}

Additionally, the lack of adequate training and uncertainty regarding the effectiveness of laser treatments were notable concerns among students. Addressing these challenges through subsidized training programs, institutional investments in laser equipment, and evidence-based teaching strategies may encourage broader acceptance and application of laser technology in clinical practice.^{8,9} Furthermore, misconceptions regarding the risks and limitations of laser use were prevalent, particularly among junior students. A considerable number of first-year and second-year students were uncertain about the potential hazards associated with laser use, such as ocular risks and improper tissue interactions. This finding emphasizes the importance of early education on laser safety protocols to mitigate risks associated with improper usage. Integrating laser safety training into the dental curriculum can enhance students' preparedness and confidence in utilizing this technology effectively.¹⁰ The efficacy of laser technology in periodontal therapy has been a subject of ongoing debate. While some studies suggest that lasers offer benefits such as reduced inflammation and accelerated healing, others argue that there is minimal evidence to support their use as an adjunct to conventional periodontal therapy.¹¹ A systematic review and meta-analysis indicated that the available evidence is insufficient to support the effectiveness of dental lasers as an adjunct to resective or regenerative surgical periodontal therapy.¹² This disparity underscores the need for further research to establish standardized protocols and determine the long-term benefits of laser applications in periodontics.

In conclusion, while laser technology holds significant potential in periodontics, there remains a considerable gap in knowledge, particularly in the early years of dental training. To bridge this gap, dental institutions should focus on integrating laser education early in the curriculum, providing hands-on exposure, and addressing financial and educational barriers to its adoption. Future studies should consider expanding the sample size and including multiple dental institutions to validate these findings on a broader scale.

CONCLUSION

This study highlights a significant gap in knowledge and awareness of laser applications in periodontics among dental students, with a clear progression in understanding observed as students advance academically. Interns and final-year students demonstrated the highest levels of awareness and confidence in using lasers, while first- and second-year students exhibited limited exposure and understanding. The findings emphasize the importance of early integration of laser education into the dental curriculum to ensure comprehensive learning and hands-on training. Despite the recognized advantages of lasers in periodontics, financial constraints and inadequate training remain key barriers to widespread adoption. Addressing these challenges through structured educational programs, workshops, and clinical demonstrations could enhance students' competence and confidence in utilizing laser technology. As laser-assisted periodontal therapy continues to evolve, it is crucial for dental institutions to prioritize laser education to prepare future dental professionals for modern, technology-driven clinical practice. By incorporating theoretical knowledge with practical exposure, students can

develop the necessary skills to integrate lasers into their future periodontal practice effectively, ultimately improving patient outcomes and advancing periodontal treatment modalities.

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Table 1 Represents the descriptive statistics based on the demographic details of the study population

Parameter	Options	Frequency	Percentage
Gender	Female	83	51.6
	Male	78	48.4
Year of Study	Final year	37	23.0
	First year	13	8.1
	Internship	58	36.0
	Second year	29	18.0
	Third year	24	14.9

Interpretation of Table 1: Descriptive Statistics Based on Demographic Details In which Gender Distribution shows

The study population consists of 161 participants. Female participants (51.6%) slightly outnumber male participants (48.4%). This indicates a fairly balanced gender distribution, with a marginally higher representation of females. Like wise the Year of Study Distribution shows The highest proportion of participants are in the Internship year (36.0%), suggesting that

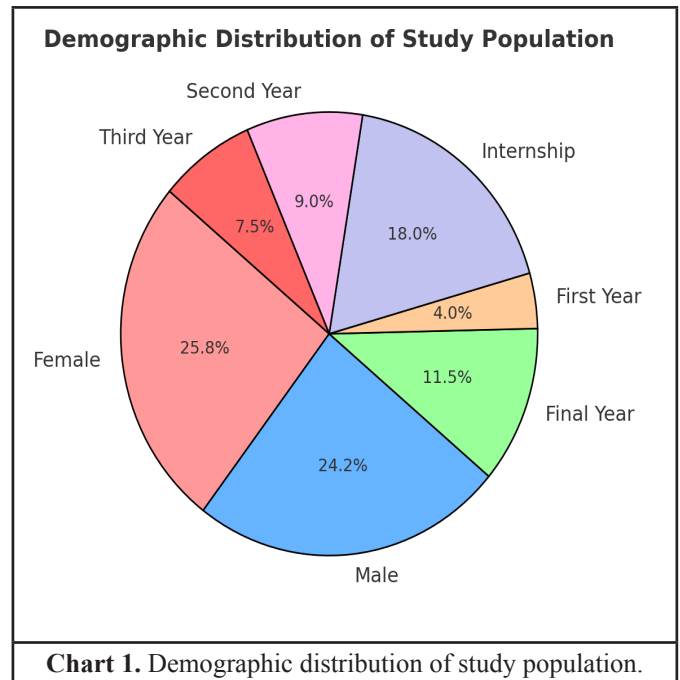


Table 2. Represents the association between the awareness based questions and response by the study population by using chi square test

Questions	Responses	Year					CHI Square	SIG
		Fianal	First	CRI	Second	Third		
Are you aware that laser are used in dental practice?	No	0	12	0	21	5	101.801 ^a	.000*
	Yes	37	1	58	8	19		
Have you seen dentist practice laser procedure?	No	6	13	2	25	22	110.832 ^a	.000*
	Yes	31	0	56	4	2		
Have you received any formal education or training on laser dentistry?	No	29	13	2	27	24	119.397 ^a	.000*
	Yes	8	0	56	2	0		
Have you heard of the following laser treatment in periodontics?	Haven't heard any of these	0	12	2	18	13	164.081 ^a	.000*
	Laser assisted new attachment procedure (LANAP)	7	0	45	4	1		
	Laser assisted periodontal therapy (LAPT)	26	1	6	2	2		
	Periodontal laser treatment (PLT)	4	0	5	5	8		

What are the potential risk or limitation of using laser in periodontics?	Can damage the retina and burn retina	8	1	30	3	1	83.737 ^a	.000*
	Cannot be used with alcohol based material	3	0	3	5	3		
	Cannot be used with oil based products	0	1	4	3	4		
	High cost	26	6	19	4	12		
	Not sure	0	5	2	14	4		
Can hard tissue laser be used for soft tissue ?	Maybe	5	6	2	14	9	57.912 ^a	.000*
	No	26	1	46	5	6		
	Yes	6	6	10	10	9		
Do you think laser will become a standard tool in periodontics?	Maybe	4	11	6	19	12	61.878 ^a	.000*
	No	0	1	2	2	3		
	Yes	33	1	50	8	9		

*P value less than or equal to 0.05 is considered statistically significant difference

Table 2 Association Between Awareness-Based Questions and Responses Using Chi-Square Test: This table examines the relationship between awareness-based questions and responses from the study population across different years of study, using the Chi-Square test. The p-values (.000) indicate a statistically significant association ($p \leq 0.05$) for all questions, meaning that the responses vary significantly based on the year of study.

a significant portion of the study population consists of those at the final stages of their education. Final-year students (23.0%)

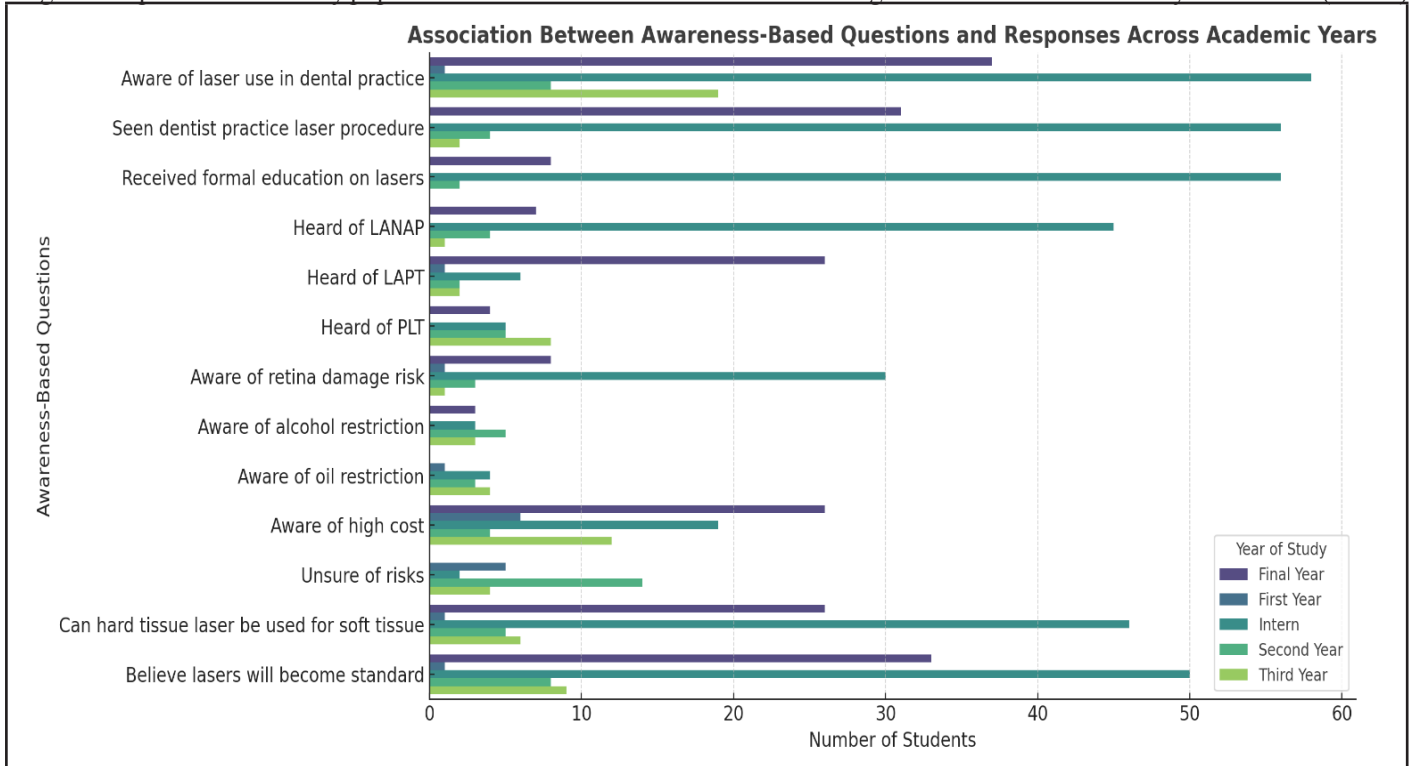


Chart 2. Association between awareness based questions and responses across academic years.

Table 3. Represents the association between the knowledge based questions and response by the study population by using chi square test

QUESTIONS	RESPONSES	YEAR					CHI SQUARE	SIG
		FINAL	FIRST	CRI	SECOND	THIRD		
How much do you know about laser application in periodontics?	Moderately familiar	30	1	11	2	11	135.609 ^a	.000*
	Not familiar at all	0	10	2	17	2		
	Somewhat familiar	7	2	27	9	11		
	Very familiar	0	0	18	1	0		
What do you think are the benefits of using lasers in periodontics	Les pain	2	0	3	2	4	174.353 ^a	.000*
	Less need for anaesthesia	4	0	6	1	1		
	Less pain	3	1	0	2	5		
	Less time taken	25	2	4	2	10		
	Not sure	0	10	0	16	2		
	Reduced bleeding	3	0	45	6	2		
What are the uses of laser in periodontics?	Calculus detection and removal	9	0	3	5	6	113.884 ^a	.000*
	Don't know	1	10	0	15	5		
	Frenectomy	1	0	19	2	4		
	Gingivectomy and crown lengthening	3	0	20	2	1		
	Soft tissue curettage	23	3	16	5	8		
What are the types of laser used	Both	30	2	51	18	11	87.156 ^a	.000*
	Hard tissue laser	4	0	1	2	4		
	Not sure	0	11	1	7	3		
	soft tissue laser	3	0	5	2	6		
Do you think laser can completely replace traditional periodontal surgical procedure?	Maybe	5	9	7	21	10	81.968 ^a	.000*
	No	25	3	11	2	8		
	Yes	7	1	40	6	6		
How important do you think laser training is for dentist students?	Fairly important	19	1	8	15	8	77.393 ^a	.000*
	Important	8	3	20	6	7		
	Not important	0	4	1	1	0		
	Slightly important	6	4	5	7	7		
	Very important	4	1	24	0	2		
Would you consider in cooperating laser into your future practice?	Maybe	6	11	5	20	17	74.974 ^a	.000*
	No	0	1	2	3	1		
	Yes	31	1	51	6	6		
If not what you think are the barriers of adopting laser technique in periodontics?	High cost	8	3	17	7	7	8.959 ^a	.706
	Lack of training	7	6	17	6	7		
	Patients acceptance	10	1	14	7	6		
	Uncertainty about effectiveness	12	3	10	9	4		

*P value less than or equal to 0.05 is considered statistically significant difference

Table 3. Association Between Knowledge-Based Questions and Responses Using Chi-Square Test

This table evaluates the relationship between knowledge-based questions and responses from the study population, analyzed using the Chi-Square test. The p-values (.000) indicate a statistically significant association ($p \leq 0.05$) for most questions, meaning that responses significantly vary based on the year of study.

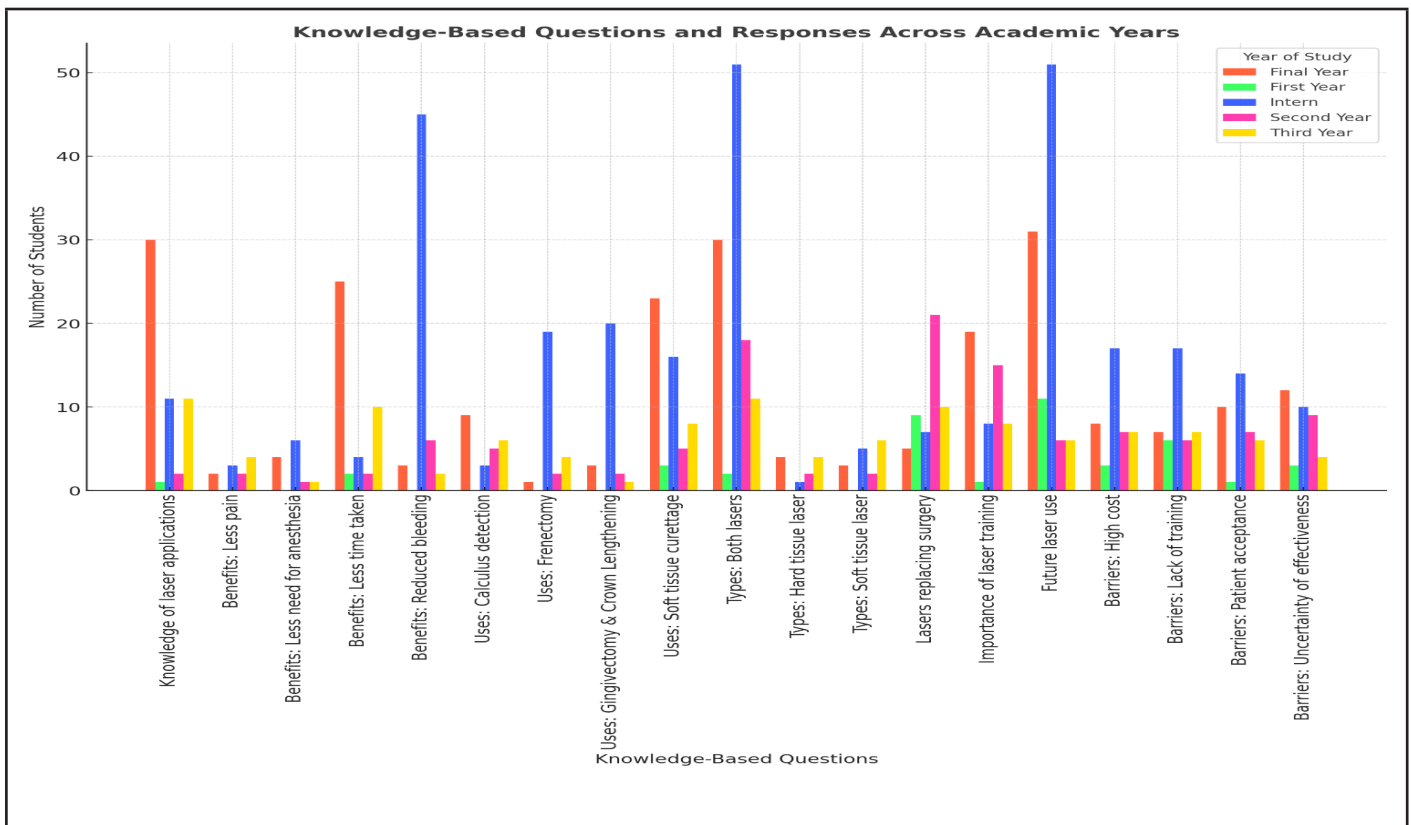


Chart 3. Association between knowledge based questions and responses across academic years

How to cite this article:

Dharshini Shree P., Kowsalya N., Balaji R and Saranya S. (2025). Bridging the knowledge gap: awareness and perception of laser technology in periodontics among dental students - a cross sectional study. *Int J Recent Sci Res.*16(03), pp.144-151.
