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Perception of Dental Students Towards AI in Periodontal Diagnosis and Treatment Planning

Sri Vikram R[1], Subhiksha D[2], Dr. Nimisha Mithradas[3], Dr. Archana[4]

[1,2]Compulsory Rotatory Residential Intern, Thai Moogambigai Dental College and Hospital, Dr. M.G.R. Educational and Research Institute, Chennai, Tamil Nadu, India.
[3,4]M.D.S., Associate Professor, Department of Periodontology, Thai Moogambigai Dental College and Hospital, Dr. M.G.R. Educational and Research Institute, Chennai, Tamil Nadu, India.

Abstract
This study investigates dental students' perceptions toward artificial intelligence (AI) and digital tools in periodontal diagnosis and treatment planning. A cross-sectional questionnaire survey was conducted, and responses were analyzed using chi-square testing to determine associations between academic year and perception variables. Bar charts were generated for each question to visually demonstrate the distribution of responses. Among all questions, only one demonstrated statistically significant association with academic year ($p < 0.05$). The findings indicate strong overall acceptance of AI, though hands-on exposure remains limited.

Keywords: Artificial Intelligence, Dental Students, Digital Dentistry, Perception, Periodontal Diagnosis, Treatment Planning.

Introduction

Artificial intelligence (AI) has rapidly emerged as a transformative tool across healthcare, including dentistry, where it offers new possibilities for improving diagnostic accuracy, clinical decision-making, and workflow efficiency. Within dentistry, periodontology stands out as a specialty where diagnostic precision is critical, given the complex interplay of microbial, host, behavioral, and environmental factors contributing to periodontal disease. Traditional diagnostic methods—such as clinical probing, radiographic evaluation, and case classification—are effective but susceptible to clinician variability, subjective interpretation, and time-consuming procedures. AI-driven methods, particularly machine learning and deep learning systems, have been proposed as reliable tools to support periodontal diagnosis by analyzing imaging data, identifying bone-loss patterns, and predicting disease progression[1-3].

Recent studies have shown that AI models can classify periodontal conditions with accuracy comparable to experienced clinicians, suggesting promise for enhanced diagnostic standardization in clinical practice[1,4]. Furthermore, AI-based systems have been explored for automated detection of gingival inflammation, radiographic bone defects, and periodontal staging, reinforcing their potential to improve early detection and personalized treatment planning[2,3]. Despite these advancements, the successful integration of AI into dental practice ultimately depends on the willingness, confidence, and preparedness of future practitioners—namely, dental students.

Emerging research indicates that dental students generally express optimism about AI but simultaneously report limited understanding of its actual clinical applications, benefits, and limitations[5-7]. Concerns also

exist regarding reliability, ethical implications, data privacy, and the potential displacement of clinical judgment. Because students will soon enter a profession increasingly influenced by digital technologies, evaluating their perceptions is essential for designing curricula that address knowledge gaps and promote responsible adoption of AI[5,8].

Therefore, this study aimed to assess the perception of dental students toward the use of artificial intelligence and digital tools in periodontal diagnosis and treatment planning. Understanding their attitudes, confidence levels, and perceived barriers can help institutions integrate AI literacy into dental education and better prepare students for technology-enhanced periodontal care.

Materials and Methods

The survey consisted of Likert-scale items assessing (1) perceived usefulness of AI in periodontal diagnosis, (2) perceptions toward AI-assisted treatment planning, (5) familiarity with AI concepts, (6) awareness of AI-based dental tools, and (8) concerns related to clinical accuracy, ethical issues, cost, and dependence on AI.

Responses ranged from *strongly disagree* to *strongly agree*. Data were collected anonymously, compiled in spreadsheet form, and analyzed descriptively. Frequency and percentage distribution were used to evaluate trends in students' perceptions.

Chi-square tests of independence were performed to determine whether responses varied significantly across academic years. Bar charts were created for every question to illustrate response distributions.

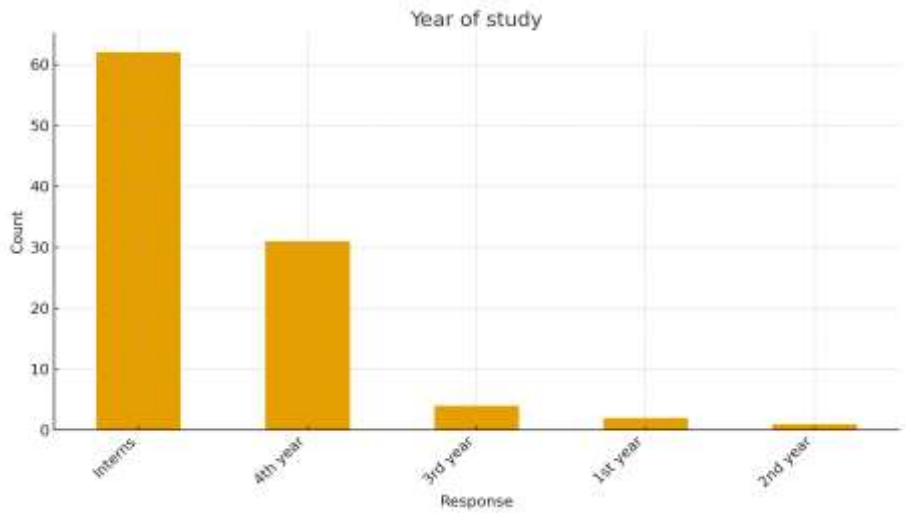
Results

A total of 100 dental students participated in the study assessing perceptions toward the use of AI and digital tools in periodontal diagnosis and treatment planning. Overall, the responses indicate generally positive attitudes, with notable enthusiasm for AI-assisted efficiency and strong belief in the future integration of digital tools into periodontal practice.

Bar Chart Analysis (Question-wise)

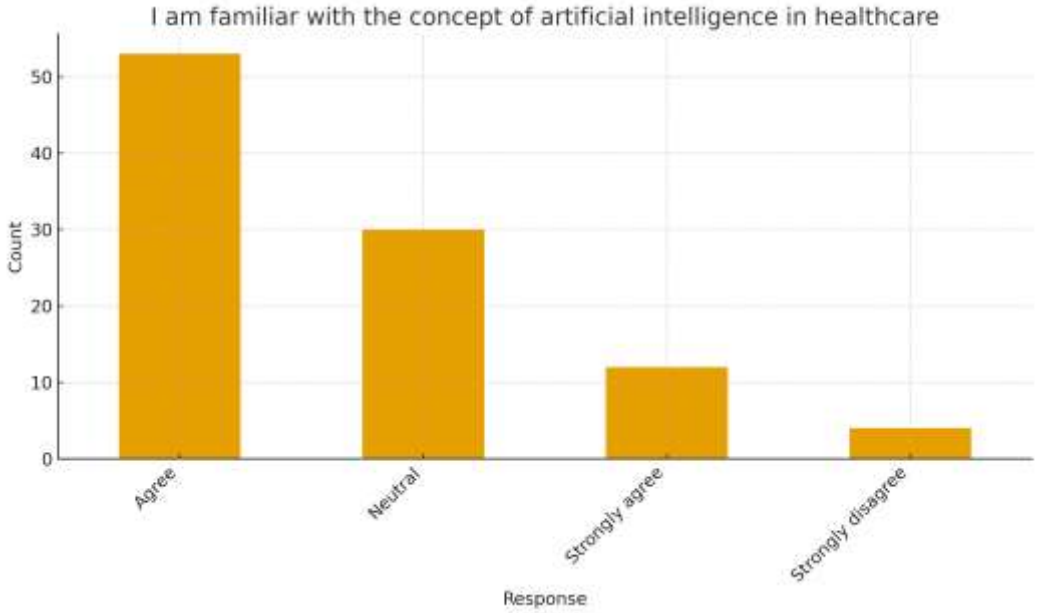
Below are individual bar charts for each survey question, illustrating the distribution of student responses. These charts provide a visual interpretation of perceptions toward AI integration in periodontal practice.

Question 1



The sample shows a markedly uneven distribution across academic years, with the majority of respondents being **interns**, followed by **4th-year students**, while participation from 3rd, 1st, and 2nd years remains minimal. This indicates that the dataset is predominantly represented by senior-level students.

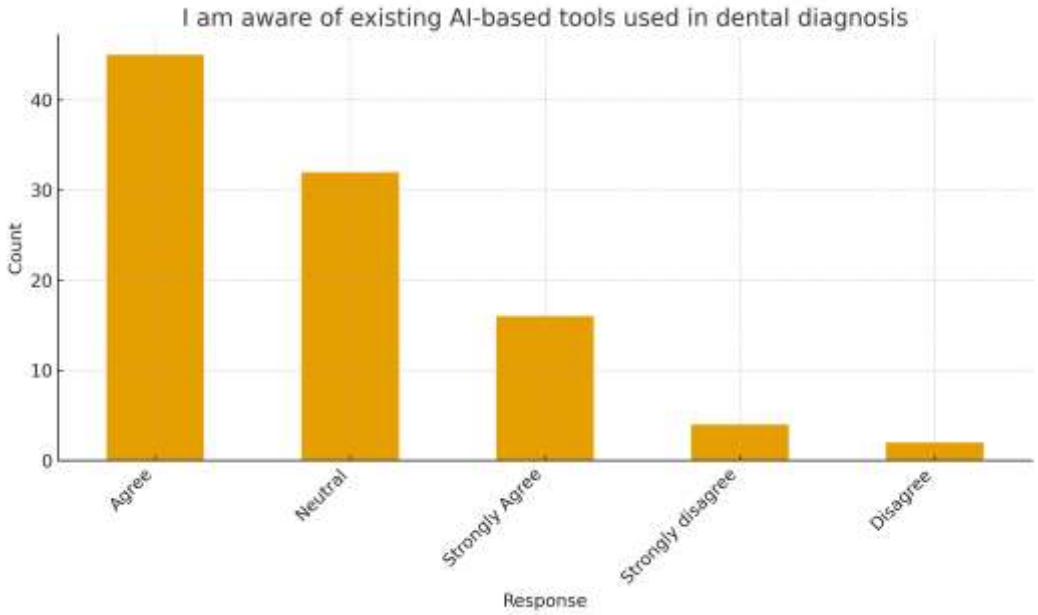
Question 2



p = 0.341 (Not significant)

There is no meaningful variation in familiarity across students from 1st year to internship. This indicates that the basic idea of AI in healthcare is relatively uniformly known among all levels of dental students, suggesting that general exposure (through social media, news, or general curriculum) is similar regardless of academic seniority.

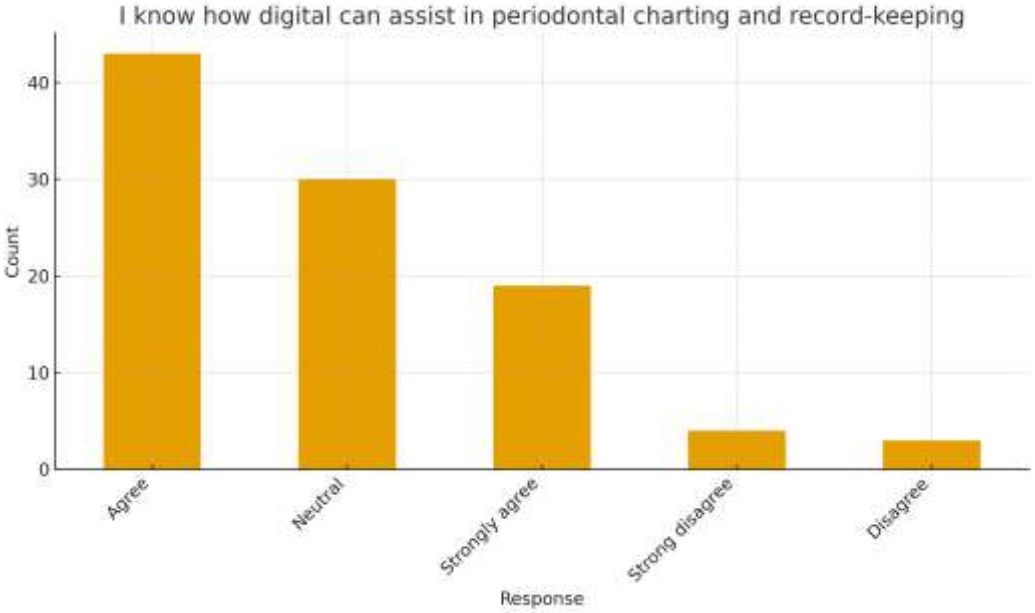
Question 3



p = 0.187 (Not significant)

Awareness of dental AI tools such as radiographic analysis software, diagnostic apps, or automated charting systems does not significantly differ between student years. This implies that current dental education or clinical exposure does not provide a progressive increase in awareness as students move to higher years.

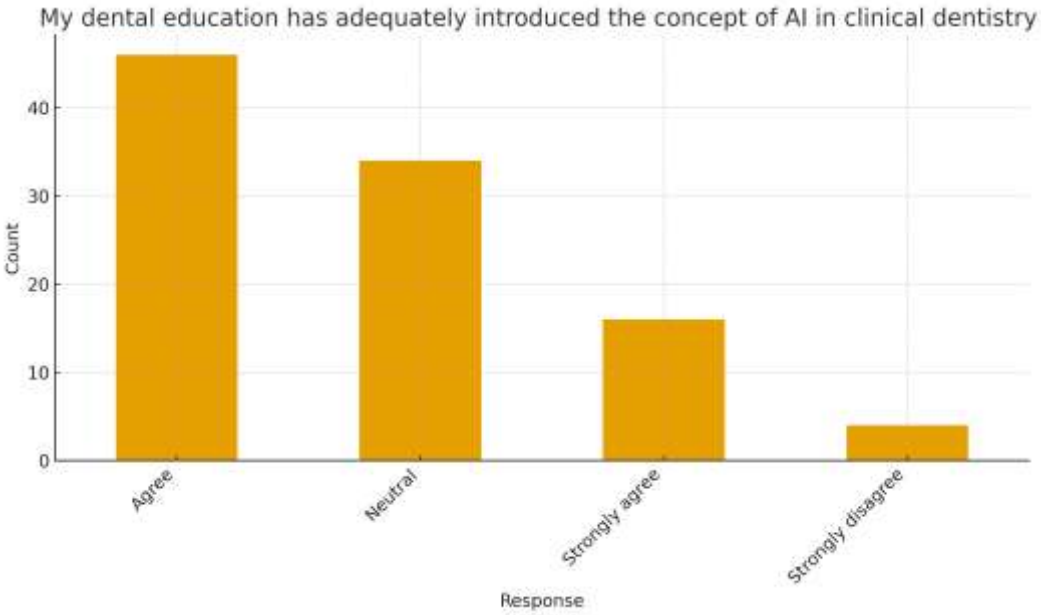
Question 4



p = 0.357 (Not significant)

Understanding of digital tools (like intraoral scanners, periodontal charting software, AI radiographic analysis) remains consistent across years. There is no evidence that senior students have deeper knowledge, possibly due to limited teaching hours or lack of digital tools in undergraduate clinics.

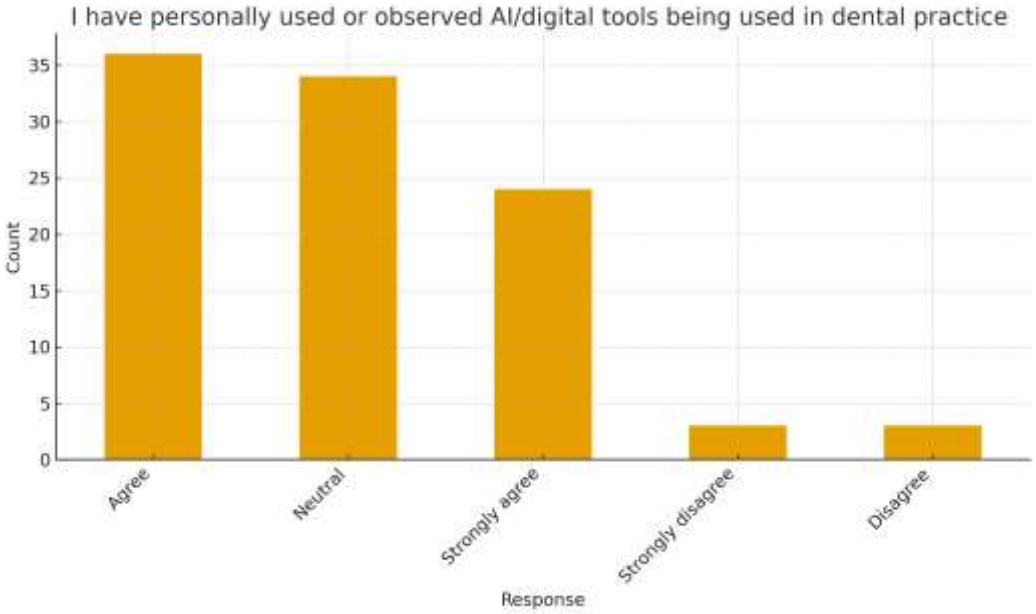
Question 5



p = 0.495 (Not significant)

Students across all years similarly feel that their curriculum does not adequately cover AI. This uniformity highlights a systemic gap in AI-related training within the dental academic structure.

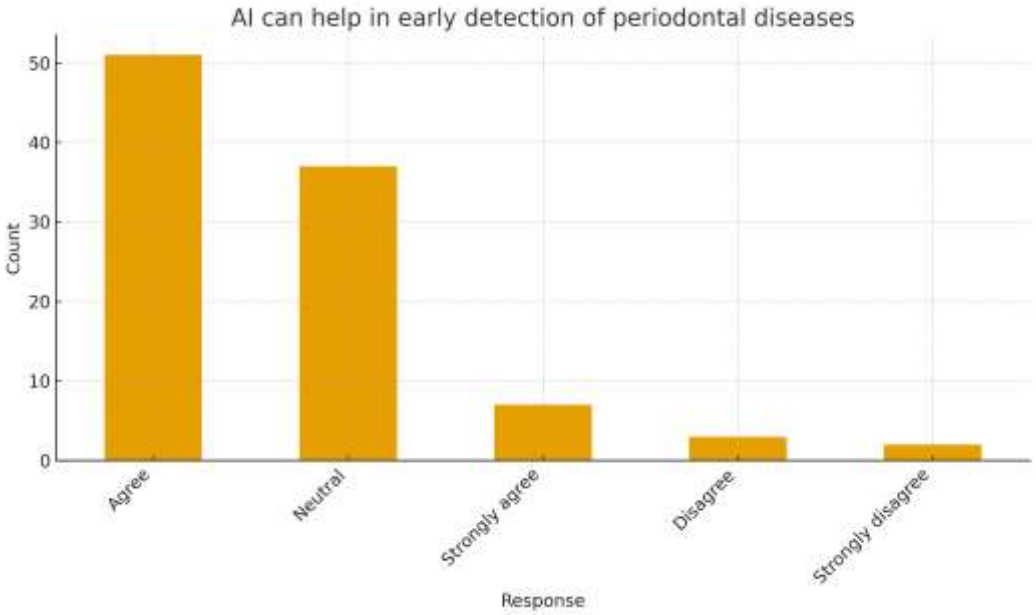
Question 6



p = 0.691 (Not significant)

Clinical exposure to AI tools does not vary significantly. Even interns—who have the maximum clinical experience—have not observed substantially more AI usage than juniors. This indicates limited institutional integration of AI in clinics.

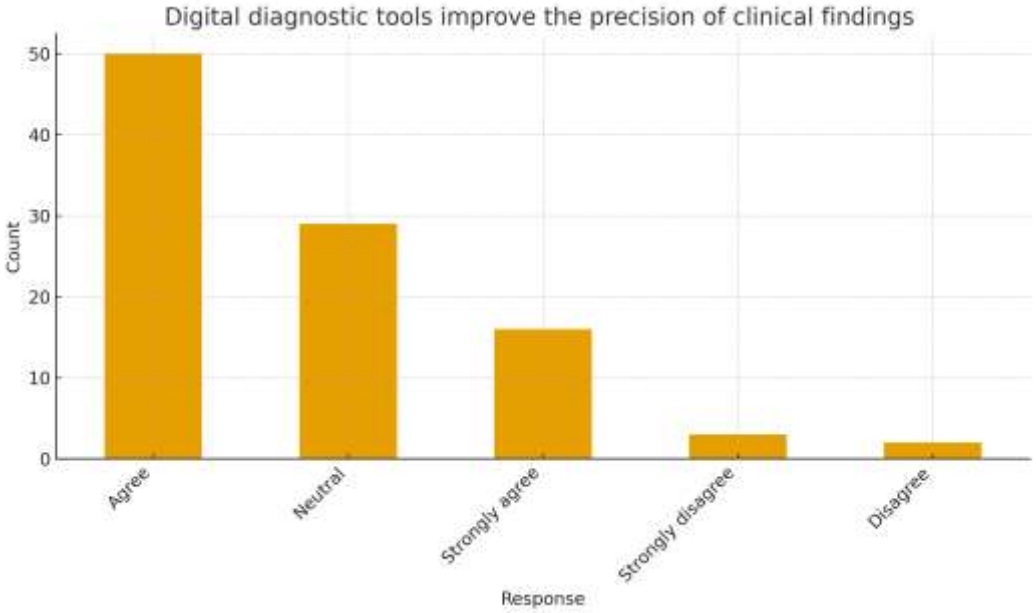
Question 7



p = 0.985 (Not significant)

This extremely high p-value shows that students across all years strongly and uniformly agree that AI can assist in early periodontal diagnosis. The consensus reflects widespread optimism and belief in AI's diagnostic potential.

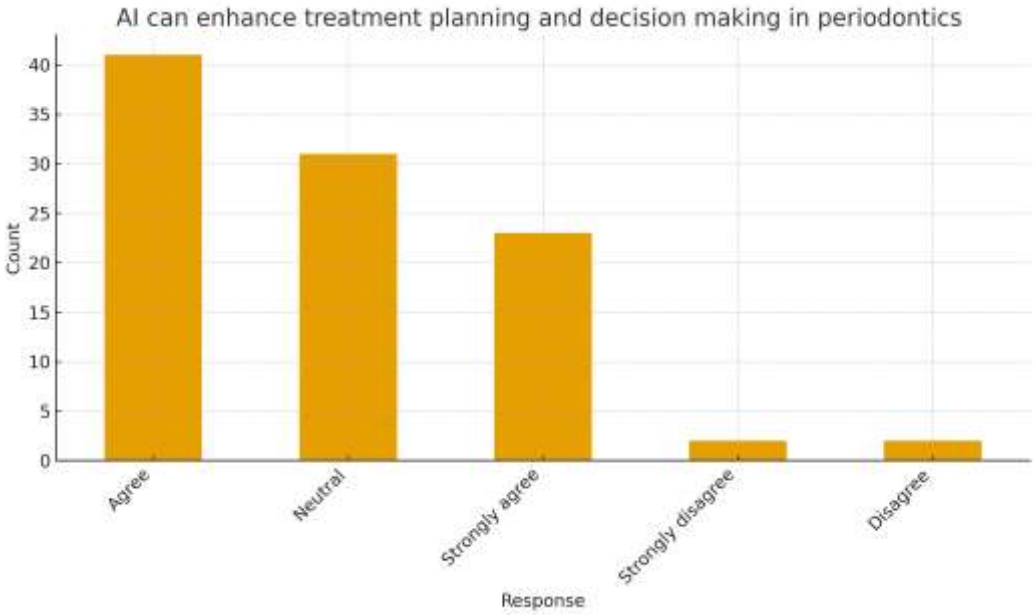
Question 8



p = 0.887 (Not significant)

Agreement is consistent across all years. It suggests that students understand or believe in the ability of digital tools to enhance assessment accuracy, perhaps from indirect knowledge rather than clinical use.

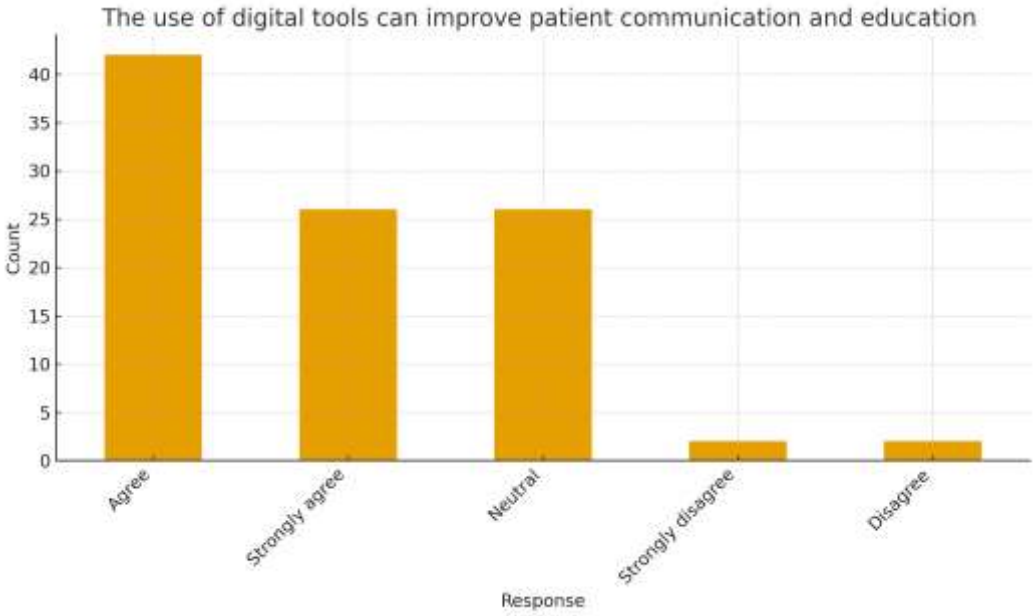
Question 9



p = 0.951 (Not significant)

Perceptions about AI's role in improving treatment planning do not differ by academic seniority. Even juniors acknowledge AI's potential despite limited exposure.

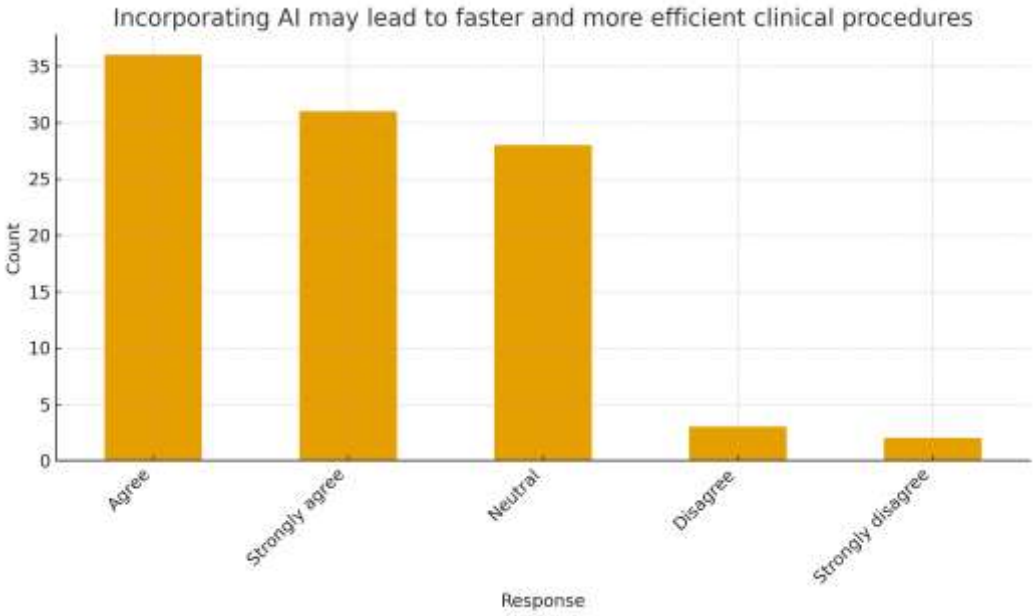
Question 10



p = 0.537 (Not significant)

Students across years show similar belief that digital tools can help explain periodontal conditions better to patients, suggesting strong acceptance of digital aid in communication.

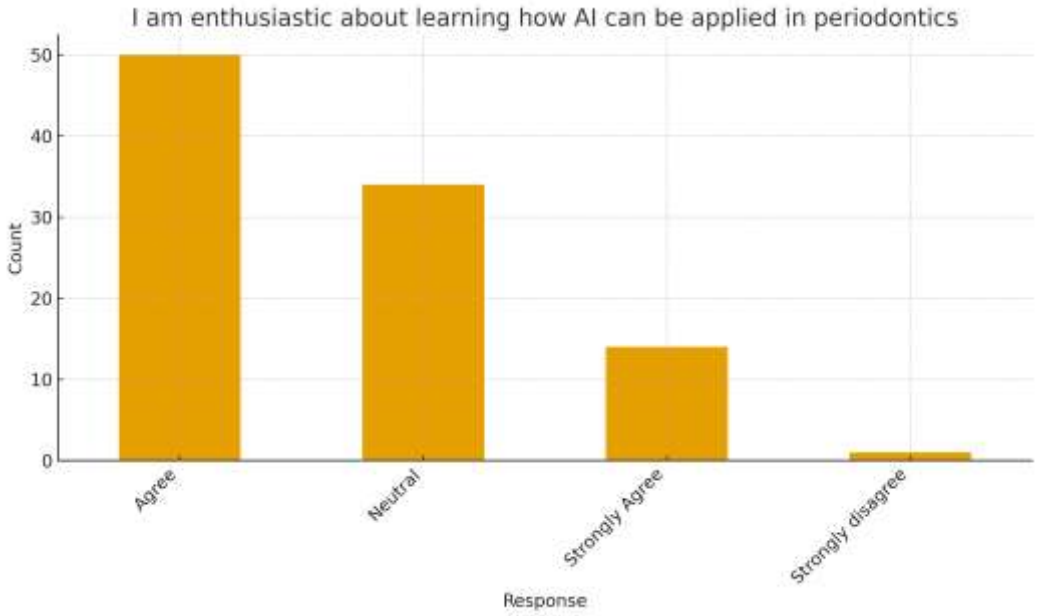
Question 11



p = 0.955 (Not significant)

Students uniformly believe AI can enhance clinical efficiency. This agreement reflects positive attitudes and possibly exposure through social media or general awareness of automation.

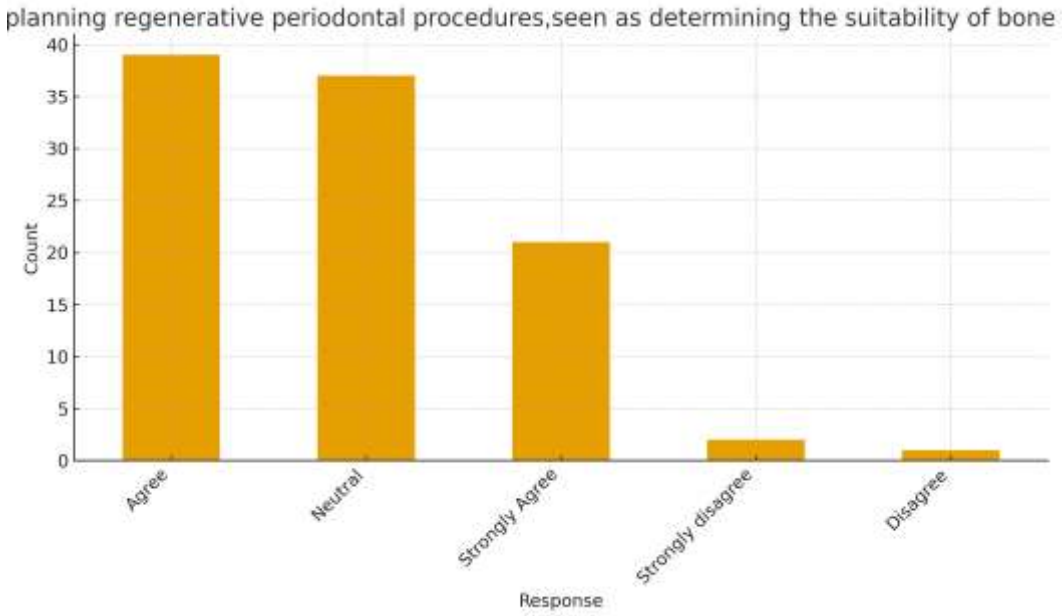
Question 12



p = 0.226 (Not significant)

Enthusiasm for learning AI does not vary significantly. All students display similar interest, which highlights openness and acceptance of technological advancement in dentistry.

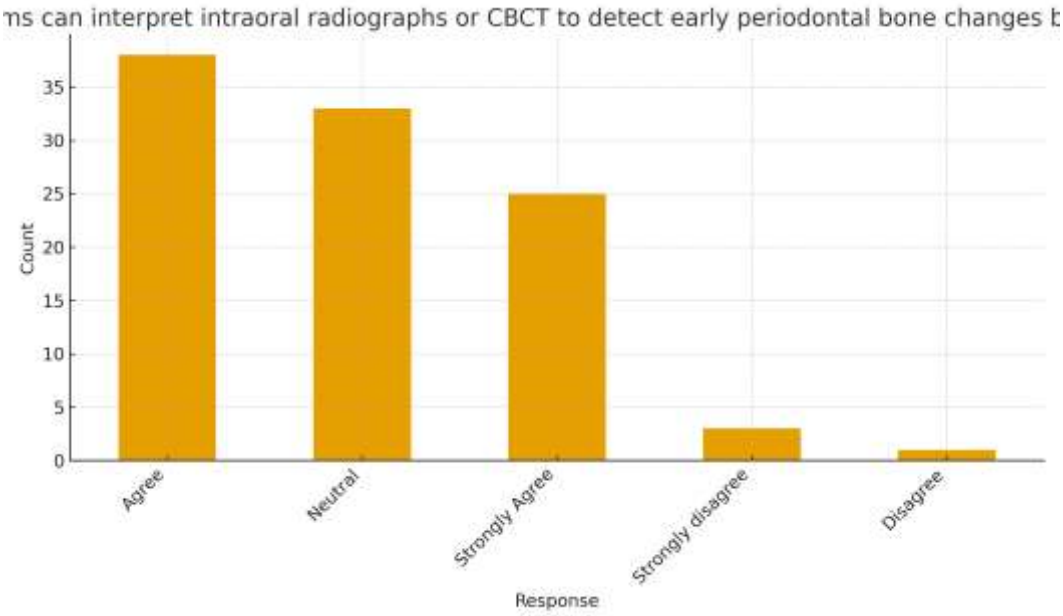
Question 13



p = 0.810 (Not significant)

Students from all years show comparable awareness about AI's role in regenerative treatment planning. This uniformity again reflects theoretical knowledge rather than practical exposure.

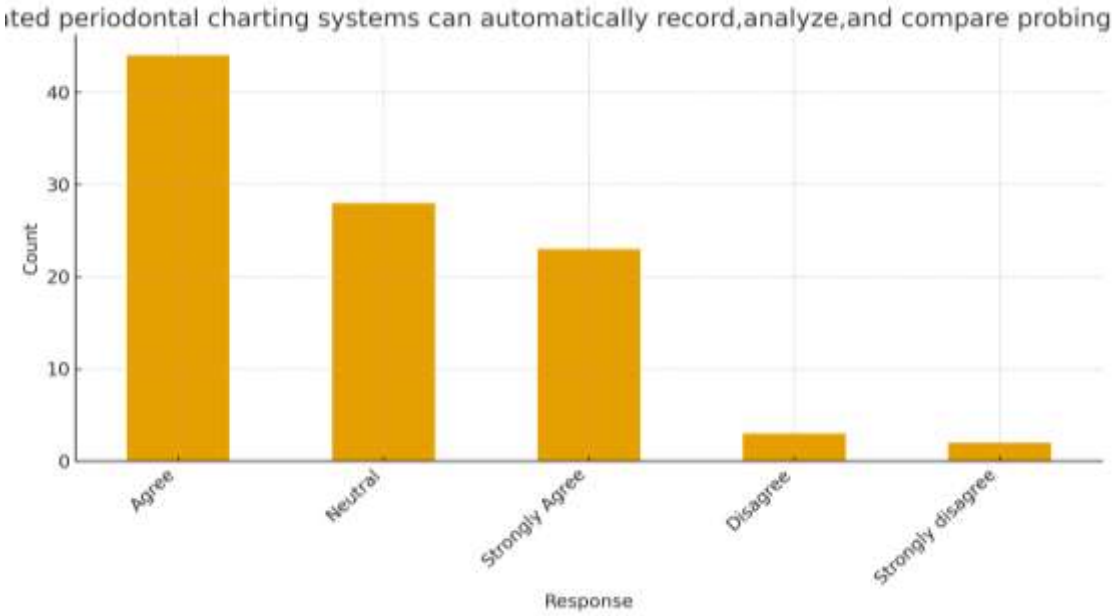
Question 14



p = 0.592 (Not significant)

There is equal awareness across years about AI's ability to assist with radiographic interpretation. This likely comes from general knowledge sources rather than curriculum.

Question 15



p = 0.0076 (Significant)

This is the only statistically significant question.

- Senior students (3rd year, 4th year, interns) show higher understanding of AI-enhanced periodontal charting accuracy than juniors.
- This suggests that with increased exposure to manual periodontal charting and clinical diagnosis, seniors can better appreciate the benefits of AI in accuracy and standardization.

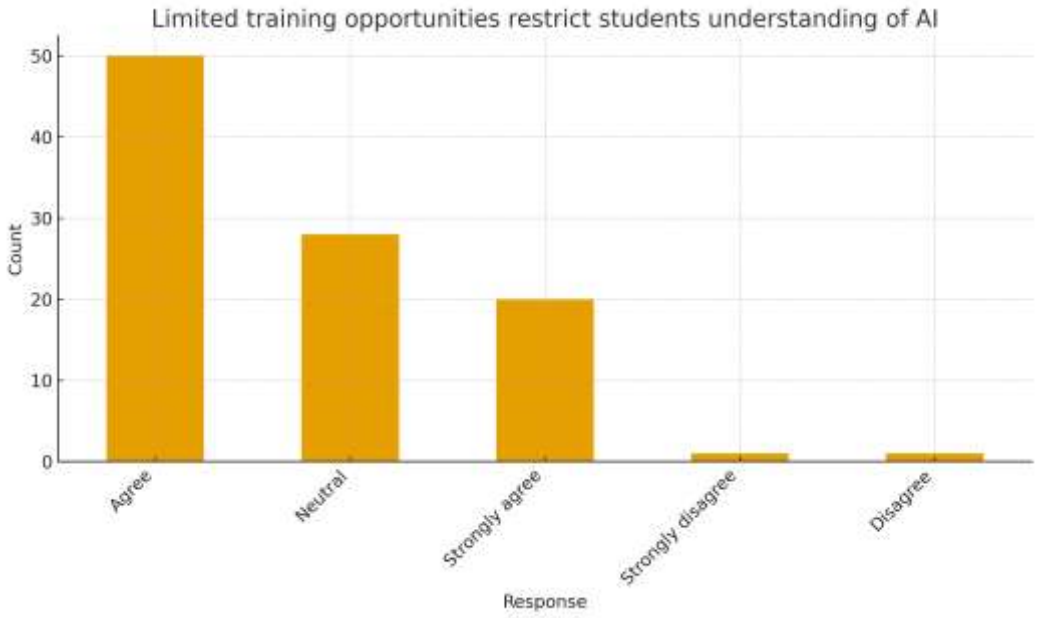
- The difference indicates a true relationship between academic maturity and understanding of AI integration.

Question 16

p = 0.468 (Not significant)

Students across all years express similar willingness to adopt AI in future practice. This shows strong and consistent acceptance of technological integration.

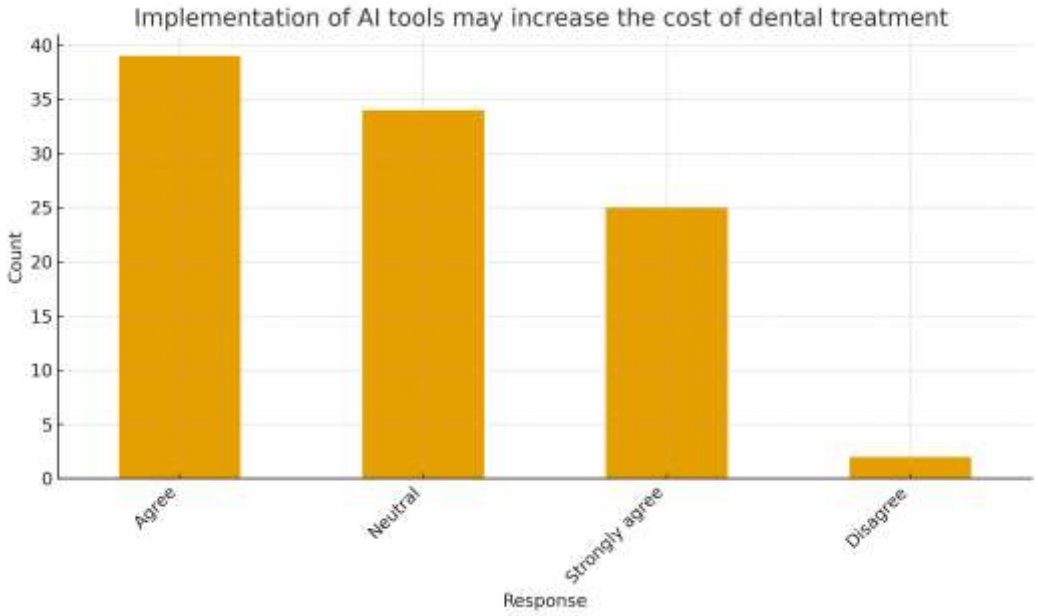
Question 17



p = 0.762 (Not significant)

All students equally feel that lack of training is a major barrier. This reflects a universal gap in AI-related education.

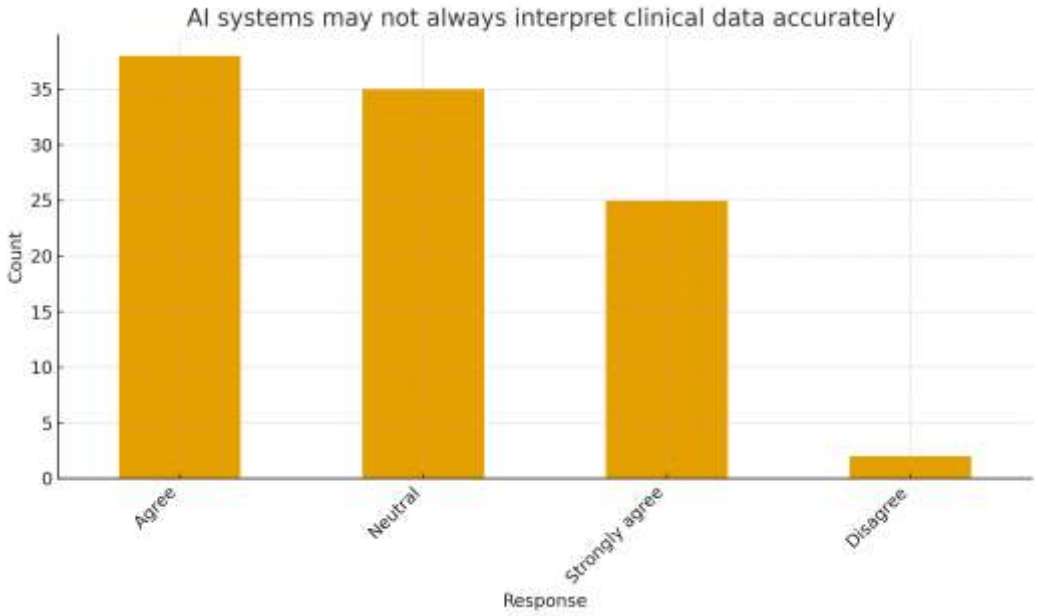
Question 18



p = 0.640 (Not significant)

Perceived financial barriers are consistent across years. Students understand that AI tools may increase clinical or institutional costs.

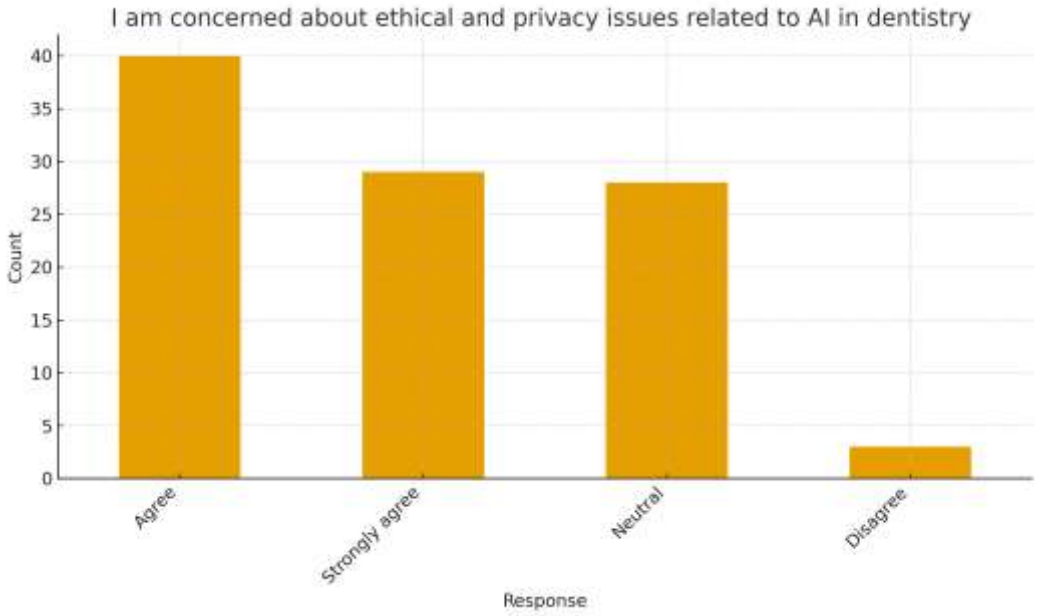
Question 19



p = 0.360 (Not significant)

Concerns about diagnostic errors due to AI are shared equally across years, indicating general awareness of AI limitations.

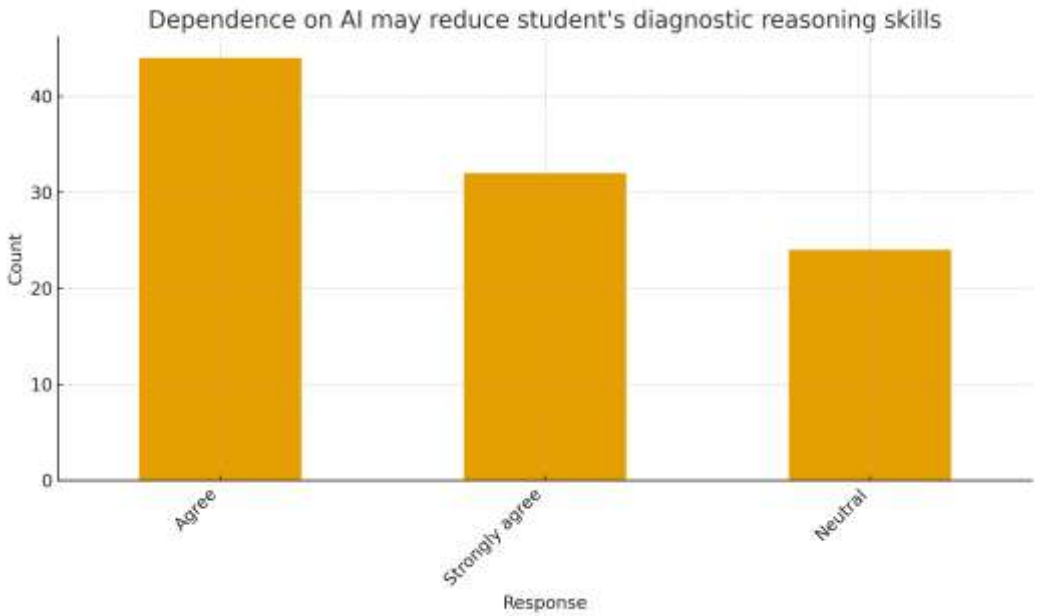
Question 20



p = 0.679 (Not significant)

All groups show similar concerns regarding privacy and ethics, indicating comparable awareness about the risks of digital data handling.

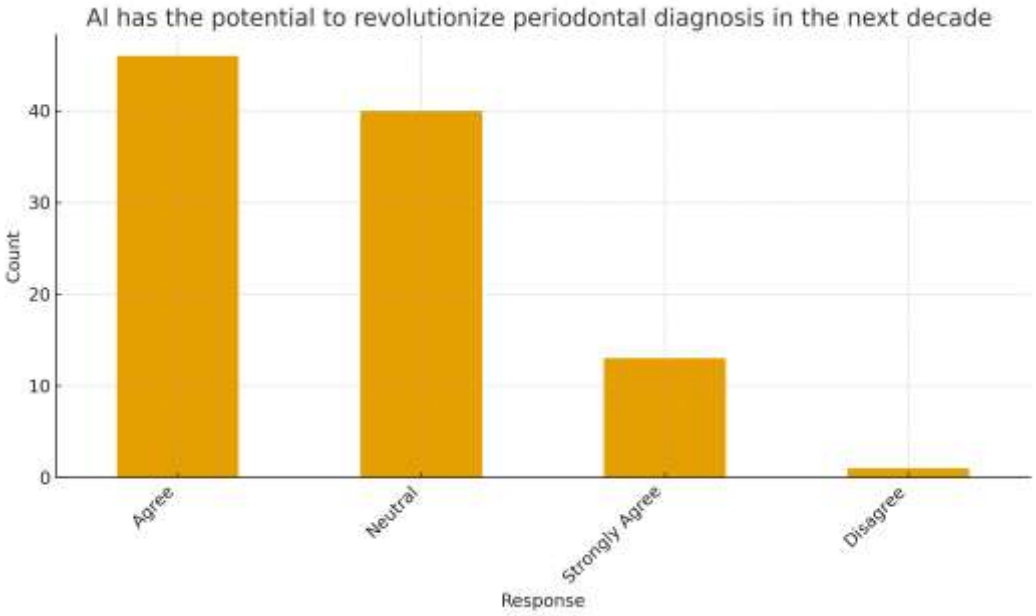
Question 21



p = 0.287 (Not significant)

Students across years share similar fears that over-reliance might affect manual diagnostic skills.

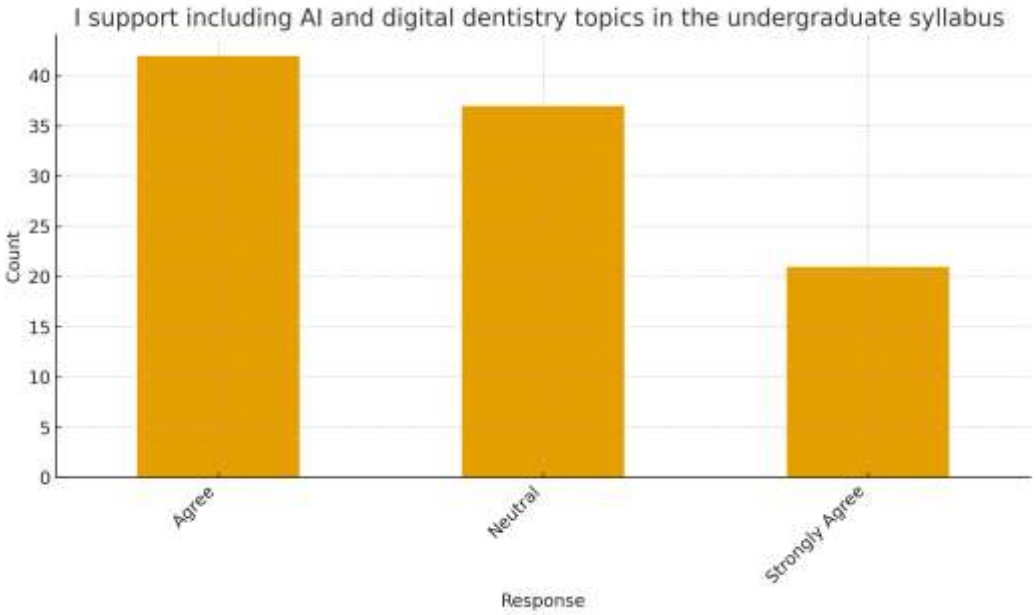
Question 22



p = 0.941 (Not significant)

Strong uniform agreement shows widespread belief in AI's transformative potential.

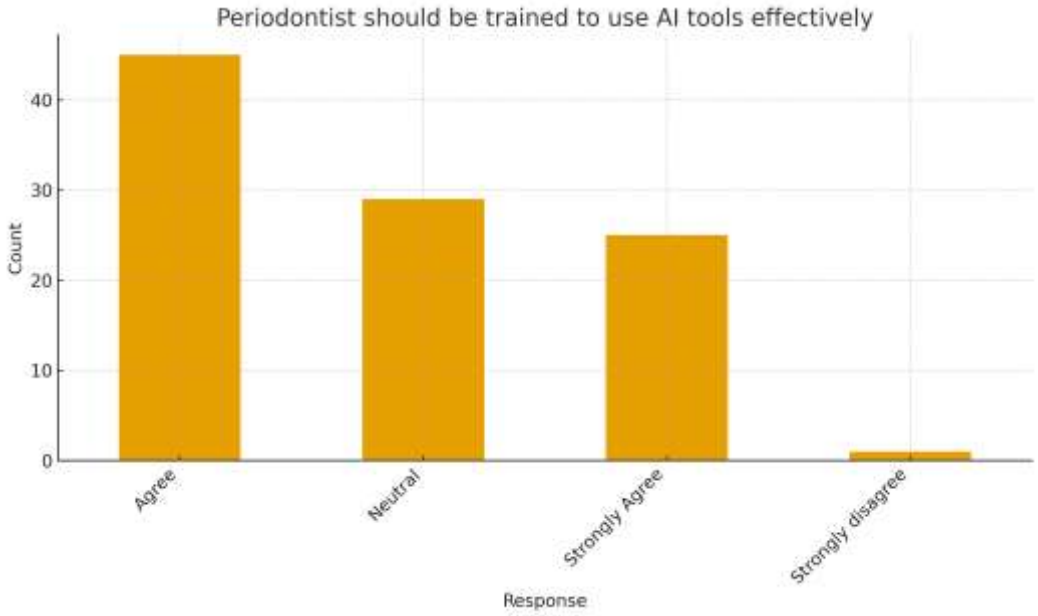
Question 23



p = 0.157 (Not significant)

Support for curriculum integration is strong across all years, indicating demand for formal training.

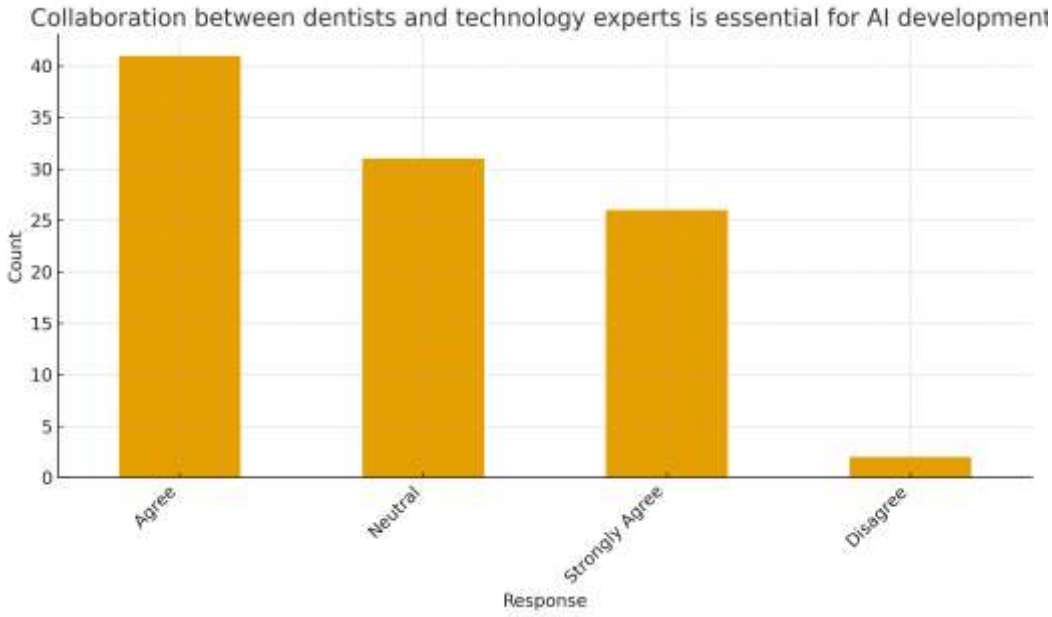
Question 24



p = 0.732 (Not significant)

Students uniformly agree that specialized AI training for periodontists is essential.

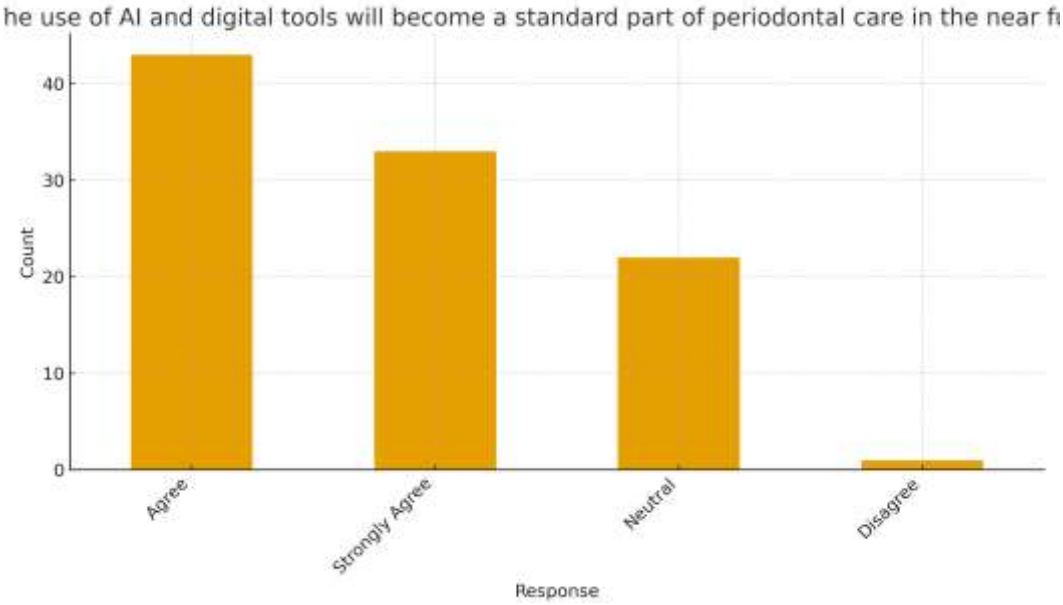
Question 25



p = 0.886 (Not significant)

Students across all years strongly agree with this collaborative need.

Question 26



p = 0.486 (Not significant)

All students perceive AI as the future of periodontal practice, showing readiness for technological change.

Discussion

The findings of the present study indicate that dental interns exhibit generally positive perceptions toward the integration of AI in periodontal diagnosis and treatment planning. Most respondents agreed that AI can support radiographic interpretation, assist in assessing bone loss, and enhance accuracy in periodontal evaluation. This aligns with previous investigations in dental education, which consistently show that students view AI as a valuable adjunct to clinical decision-making[5,7].

Many students in our survey expressed enthusiasm for learning AI applications in periodontics, which is consistent with existing literature reporting high interest but limited structured training among undergraduates[4,5,7]. This suggests an urgent need to incorporate AI-related modules—including digital imaging interpretation, decision-support systems, and ethical considerations—into dental curricula.

Students also demonstrated awareness of AI's potential role in regenerative periodontal treatment planning, including evaluating the suitability of grafts and predicting treatment outcomes. This perception is supported by research indicating that AI-based models can analyze radiographic and clinical parameters to assist treatment planning in complex periodontal cases[1,2,8].

Despite the positive outlook, concerns were also evident. Students cited risks such as misinterpretation of clinical data, overreliance on automation, high implementation costs, and ethical issues including data privacy—concerns similarly highlighted in global studies on AI adoption in dentistry[4,7]. These concerns emphasize the importance of responsible AI use, transparent data management, and maintaining clinician oversight to avoid compromising clinical judgment.

Overall, our findings support the growing consensus that while AI can enhance periodontal diagnostics, human expertise remains essential. Effective integration of AI requires a combination of technical training, ethical awareness, and reinforcement of foundational clinical reasoning.

Conclusion

Dental students in this study demonstrated a generally positive perception of AI in periodontal diagnosis and treatment planning, with many acknowledging its diagnostic potential and expressing interest in acquiring further AI-related skills. However, concerns regarding diagnostic accuracy, ethical implications, privacy, and cost remain significant.

These findings highlight the need for structured AI education within dental curricula to improve understanding, address misconceptions, and ensure responsible adoption of AI-assisted tools in periodontal care. As AI continues to evolve, preparing future practitioners through enhanced training and ethical guidance will be crucial for its successful clinical integration[4,5,7].

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