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# Perceptions, Attitude and Barriers Towards Artificial Intelligence in Periodontics among Postgraduate Students of Periodontics: an Online Survey

Dr Pooja H Amoji[1], Dr Prajwal Hadli[2], Dr Praveen N C[3], Dr Rashmi A[4], Dr M B Patil[5]

[1]*Department of Periodontics, College of Dental Sciences, Davangere, Karnataka, India (Postgraduate)*
[2]*Department of Periodontics, College of Dental Sciences, Davangere, Karnataka, India (Postgraduate)*
[3]*Department of Periodontics, College of Dental Sciences, Davangere, Karnataka, India (Professor)*
[4]*Department of Periodontics, College of Dental Sciences, Davangere, Karnataka, India (Professor)*
[5]*Department of Periodontics, College of Dental Sciences, Davangere, Karnataka, India (Professor and Head of Department)*

**Abstract*:* Aim*:*** *To know attitudes, perceptions and barriers towards the use of Artificial Intelligence (AI) in dentistry among postgraduate students of Periodontics.*

**Methodology***: A questionnaire-based cross-sectional study was conducted among participants pursuing post-graduation. The questionnaire consisted of 15 close-ended questions divided into sections of attitude, perception and barriers. The data was analysed using Statistical Package for Social Sciences (SPSS) version 24.0.*

**Result*:*** *Out of 206 respondents, 76% were aware of AI tools relevance to their speciality. 81% believed that AI can be effectively utilized for 3-dimensional implant positioning and planning. 70% believe inadequate exposure to AI during postgraduate periodontics training limits their confidence in using such tools clinically.*

**Conclusion:** *This study concluded that students of postgraduation in periodontics were aware of the AI tools. Participants were positive when asked if AI can be effectively utilized for3-dimensional implant positioning and planning. Participants believed that the barriers to the introduction of AI in dentistry are lack of exposure at PG level and high cost.*

**Keywords**: *Artificial intelligence, Knowledge, Awareness, Post graduate students, Survey*

## I. Introduction

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think and act in ways similar to humans. It encompasses a wide spectrum of emerging technologies that increasingly influence all sectors of society, including healthcare and dentistry. In dentistry, AI is a rapidly expanding area, primarily aimed at assisting clinicians in delivering high-quality patient care while improving efficiency and reducing treatment time. Multiple AI applications are being developed across various dental specialities.[1]

Currently, AI is widely utilized in healthcare through machine learning (ML) and deep learning (DL). ML, a branch of AI, involves constructing statistical models to classify data or images and predict risks or outcomes using different methods. DL, a subfield of ML, employs algorithms inspired by the human brain, known as

artificial neural networks (ANNs). These consist of interconnected "neurons" capable of processing information and learning from data. Within DL, convolutional neural networks (CNNs) are particularly effective for interpreting complex image modalities. CNNs process data in small, overlapping regions, enabling recognition of local patterns in images.[2]

DL-based systems are now applied in several fields of medicine and dentistry, such as cancer diagnosis, oral radiology, denture design, temporomandibular joint disorder assessment, caries detection, periodontal disease diagnosis, and cephalometric analysis.[2]

In periodontics, AI has growing significance for diagnosis, treatment planning, and patient management. A few surveys conducted in India have explored this. For example, Chawla et al. (2023) surveyed 275 periodontists and interns across Maharashtra and reported that senior staff were more aware of AI[3]. Similarly, Kalburgi et al. (2023) surveyed 266 interns and postgraduate students, and reported that PG students demonstrated greater awareness and knowledge than and found that most respondents had a reasonable understanding of AI use in periodontology.[4]

The present survey is structured into three sections—Perceptions, Attitude, and Barriers—with five closed- ended questions in each, totalling fifteen. To better understand the awareness and knowledge of AI among students across the country, survey to assess their knowledge is required. This study was conducted among postgraduate students of periodontics from different dental colleges in Karnataka, India. The secondary objective was to determine whether incorporating AI into the academic curriculum could enhance its clinical acceptance.

As AI technologies continue to advance, dental professionals, students, and educators must be well-informed about data science, robo-ethics, data analysis, and AI algorithms, since the future of healthcare is expected to involve increasing reliance on AI-based innovations.

## II. Materials and Methods:

**2.1 Study design:** A cross-sectional questionnaire study was conducted amongst the postgraduates in periodontics of Karnataka, India to access perceptions, attitudes and barriers for the application of AI in the field of Periodontology. The data was collected for a period of 1 month from January 2024 to February 2024. The research project was approved by the university ethics and dental review committee (Document reference number: CODS/IEC/58/2023-24). This study was conducted in accordance with the ethical standards of Declaration of Helsinki.

**2.2 Study area and population:** Study was conducted among postgraduate students of Periodontics across Karnataka, India

**2.3 Inclusion and exclusion criteria:** Post graduate students of Periodontics studying in 1st, 2nd and 3rd year were included in the study. Interns, Under-graduates, Faculty, Periodontists who were Private practitioners and Post graduates of other specialities were excluded.

**2.4 Sample size estimation:** Sample size was calculated using estimations from main article with 95% confidence level and 5% margin error.

**2.5 Sampling and data collection procedure:** Link was created using web based electronic software (Google forms) for sharing via social media platform (WhatsApp) to 250 postgraduate students of periodontics studying in various government and private dental colleges of Karnataka, among which 206 responded. The survey questionnaire collected information on the demographics and educational background of dental postgraduate students, along with their knowledge, attitudes, and perceived barriers regarding the application of AI. Participants selected 1 option among 5 options given, based on their level of agreement. Responses were recorded through single webpage which included "submit" button and permitted only one submission per link.

**2.6 Tools and technique:** Survey comprised of total of 15 questions, divided into three sections: perceptions, attitudes, and barriers, with five questions in each category. A five-point Likert scale (Strongly agree, Agree, Neutral, Disagree, Strongly disagree) was applied requiring participants to indicate their level of agreement or

understanding of the statements.

**2.7 Statistical analysis:** Data from questionnaires were automatically updated to google spreadsheets. Data analysis was performed using IBM SPSS Statistics, Version 23. Descriptive statistics, including frequencies and percentages, were calculated. Sociodemographic variables and participants' responses were summarized using frequency distributions and tabular presentations. To evaluate the significance of associations between variables, non-parametric tests including the Chi-square test were employed and level of significance was set at $p < 0.05$.

## III. Results:

**Demographic data:** During study period 250 postgraduate students of periodontics completed the survey, among which 206 responded and 67% (n = 139) were female and 32% (n = 67) were male. All the students were from the public and private sector dental colleges of Karnataka. Students who completed the survey were from 1st year 32% (n = 67), 2nd year 34% (n= 71), 3rd year 34% (n = 68). Age group of participants was between 20 years to 40 years.

**Responses assessing perceptions of students on AI**: Only 76% of students were aware of AI tools relevance to your speciality. 44% were aware of sensors that use software for determination of halitosis in patients. 14% were familiar with software that could identify implant system from panoramic radiograph. 34% of them were aware of software that measures periodontal pocket. 40% of them were aware of haptic-based dental simulator which simulates teeth and gingiva.

**Responses assessing attitudes of students on AI**: 44% of them think AI can effectively be utilized for both screening and planning treatment in periodontics. 32% of students believe that AI could be used as a quality control tool to assess the success of treatments. 81% of them agreed that AI could be used in 3-dimensional implant positioning and planning. 45% of them believe AI-assisted self-monitoring tool would help patients in maintaining of oral hygiene. 29% of them think AI tools would be helpful in differentiating chronic and aggressive forms of periodontal diseases.

**Responses assessing barriers of students on AI**: 32% of them think that lack of AI tools which are trained specifically on periodontal datasets limits their effectiveness in diagnosing periodontal diseases. 50% of them believe that the high cost of AI-based diagnostic tools is a barrier to their implementation in routine periodontal practice. 33% of them feel that current AI systems are not yet reliable enough to distinguish between different stages in classification of periodontal disease. 70% of them think inadequate exposure to AI during postgraduate periodontics training limits their confidence in using such tools clinically. 29% of them feel that misdiagnosis by AI affected their willingness to use AI-based tools for periodontal treatment planning or prognosis.

## 3 Tables

**TABLE 1: Demographic data**

| Variable | Category | n (%) |
|---|---|---|
| Age group (in years) | 20-25 | 66 (32%) |
| | 25-30 | 135 (65%) |
| | 30-35 | 5 (2%) |
| | 35-40 | 0 (0%) |
| Year of study | 1st | 67 (32%) |
| | 2nd | 71 (34%) |
| | 3rd | 68 (33%) |
| Gender | Male | 67 (32%) |
| | Female | 139 (67%) |

**TABLE 2: Comparison of response frequencies of students according to year of study and gender using chi-square test**

| **Perception based questions** | Response | 1st year | 2nd year | 3rd year | Total N (%) | P value |
|---|---|---|---|---|---|---|
| AI tools relevance to speciality | Strongly agree | 28 | 49 | 41 | 118 (57%) | 0.002 |
| | Agree | 10 | 8 | 22 | 40 (19%) | |
| | Neutral | 11 | 5 | 2 | 18 (8.7%) | |
| | Disagree | 12 | 3 | 2 | 17 (8%) | |
| | Strongly disagree | 6 | 6 | 1 | 13 (6%) | |
| Sensors that use AI tool for determination of halitosis | Strongly agree | 10 | 17 | 25 | 52 (25%) | 0.235 |
| | Agree | 13 | 10 | 18 | 41 (19%) | |
| | Neutral | 13 | 3 | 5 | 21 (10%) | |
| | Disagree | 17 | 17 | 6 | 40 (19%) | |
| | Strongly disagree | 14 | 24 | 14 | 52 (25%) | |
| Tool to identify implant system from panoramic radiograph | Strongly agree | 2 | 3 | 9 | 14 (6%) | 0.679 |
| | Agree | 7 | 6 | 4 | 17 (8%) | |
| | Neutral | 15 | 17 | 11 | 43 (20%) | |
| | Disagree | 24 | 19 | 7 | 50 (24%) | |
| | Strongly disagree | 19 | 26 | 37 | 82 (39%) | |
| Tool that measures periodontal pocket | Strongly agree | 8 | 7 | 12 | 27 (13%) | 0.772 |
| | Agree | 4 | 12 | 28 | 44 (21%) | |
| | Neutral | 4 | 15 | 5 | 24 (11%) | |
| | Disagree | 14 | 17 | 11 | 42 (20%) | |
| | Strongly disagree | 37 | 20 | 12 | 69 (33%) | |
| Haptic-based dental simulator which simulates teeth and gingiva | Strongly agree | 4 | 18 | 5 | 27 (13%) | 0.671 |
| | Agree | 5 | 20 | 32 | 57 (27%) | |
| | Neutral | 19 | 9 | 16 | 44 (21%) | |
| | Disagree | 15 | 12 | 6 | 33 (16%) | |
| | Strongly disagree | 24 | 12 | 9 | 45 (21%) | |
| **Attitude based questions** | | | | | | |
| Screening and treatment planning in periodontics | Strongly agree | 12 | 19 | 13 | 44 (21%) | 0.441 |
| | Agree | 12 | 13 | 23 | 48 (23%) | |
| | Neutral | 10 | 7 | 10 | 27 (%) | |
| | Disagree | 32 | 25 | 12 | 72 (34%) | |
| | Strongly disagree | 1 | 7 | 10 | 18 (8%) | |
| Tool to assess the success of treatments | Strongly agree | 9 | 5 | 10 | 24 (11%) | 0.247 |
| | Agree | 6 | 18 | 21 | 45 (21%) | |
| | Neutral | 11 | 9 | 2 | 22 (10%) | |
| | Disagree | 26 | 29 | 32 | 87 (42%) | |
| | Strongly disagree | 15 | 10 | 3 | 28 (13%) | |
| Tool for 3-dimensional implant positioning and planning | Strongly agree | 33 | 51 | 37 | 121 (58%) | 0.03 |
| | Agree | 20 | 12 | 17 | 49 (23%) | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Neutral | 4 | 2 | 3 | 9 (4%) | |
| | Disagree | 12 | 3 | 10 | 25 (12%) | |
| | Strongly disagree | 1 | 3 | 1 | 5 (2%) | |
| AI-assisted self-monitoring tool in maintenance of oral hygiene | Strongly agree | 18 | 12 | 23 | 53 (25%) | 0.247 |
| | Agree | 12 | 21 | 10 | 43 (20%) | |
| | Neutral | 5 | 9 | 10 | 24 (11%) | |
| | Disagree | 11 | 4 | 19 | 34 (31%) | |
| | Strongly disagree | 21 | 25 | 6 | 52 (25%) | |
| AI tools in differentiating chronic and aggressive forms of periodontal diseases | Strongly agree | 7 | 8 | 13 | 16 (7%) | 0.235 |
| | Agree | 15 | 12 | 20 | 47 (22%) | |
| | Neutral | 5 | 9 | 4 | 18 (8%) | |
| | Disagree | 20 | 17 | 13 | 50 (24%) | |
| | Strongly disagree | 20 | 25 | 17 | 62 (30%) | |
| **Barrier based questions** | | | | | | |
| Lack of AI tools trained specifically on periodontal datasets | Strongly agree | 13 | 17 | 11 | 41 (19%) | 0.678 |
| | Agree | 4 | 8 | 16 | 28 (13%) | |
| | Neutral | 7 | 19 | 9 | 35 (16%) | |
| | Disagree | 26 | 14 | 21 | 61 (29%) | |
| | Strongly disagree | 17 | 13 | 11 | 41 (19%) | |
| High cost of AI-based diagnostic tools | Strongly agree | 25 | 43 | 49 | 117 (36%) | 0.02 |
| | Agree | 13 | 10 | 6 | 29 (14%) | |
| | Neutral | 2 | 1 | 3 | 6 (2%) | |
| | Disagree | 7 | 12 | 2 | 21 (10%) | |
| | Strongly disagree | 20 | 5 | 8 | 33 (16%) | |
| Current AI system can't be relied to distinguish between different stages in classification of periodontal disease | Strongly agree | 4 | 12 | 12 | 28 (13%) | 0.235 |
| | Agree | 16 | 11 | 16 | 43 (20%) | |
| | Neutral | 8 | 19 | 13 | 40 (19%) | |
| | Disagree | 27 | 12 | 19 | 48 (23%) | |
| | Strongly disagree | 12 | 17 | 8 | 37 (13%) | |
| Inadequate exposure to AI during postgraduate periodontics training | Strongly agree | 37 | 25 | 31 | 93 (45%) | 0.04 |
| | Agree | 12 | 17 | 19 | 48 (25%) | |
| | Neutral | 5 | 8 | 5 | 18 (8%) | |
| | Disagree | 7 | 9 | 9 | 25 (12%) | |
| | Strongly disagree | 6 | 12 | 4 | 22 (10%) | |
| Concern about misdiagnosis by AI | Strongly agree | 12 | 9 | 7 | 28 (13%) | 0.442 |
| | Agree | 9 | 10 | 16 | 35 (16%) | |
| | Neutral | 15 | 19 | 14 | 48 (23%) | |
| | Disagree | 15 | 21 | 12 | 48 (23%) | |
| | Strongly disagree | 16 | 12 | 19 | 47 (22 %) | |

## IV. Discussion

Artificial intelligence (AI) in dentistry is a rapidly expanding field, primarily aimed at assisting clinicians in delivering high-quality patient care while enhancing efficiency and reducing treatment time. Numerous applications are being developed across various dental specialties. In periodontics, notable advances include haptics-based virtual reality periodontal training simulators, the development of ultrasonographic periodontal probes, AI tools for detecting halitosis, and systems capable of differentiating between chronic and aggressive forms of periodontitis. Additional applications involve automated segmentation of gingival diseases from oral images, AI-assisted treatment planning, diagnosis of bone loss and periodontally compromised teeth, prediction of dental implant success, identification of implant systems from panoramic radiographs, and CAD-integrated software for implant crown fabrication[1].

In our study, out of 206 respondents, 67% were female and 32% were male, which may be attributed to the higher proportion of females pursuing dentistry and 67% were first-year, 71% were second-year, and 68% were third-year postgraduates. The higher awareness of AI among senior students may be attributed to their greater exposure to research publications. Understanding the perceptions, attitudes, and barriers of periodontists is crucial for the successful integration of AI in periodontal healthcare. To the best of our knowledge, this is the first study conducted exclusively on postgraduate students of periodontics in Karnataka, India. Previous studies on AI in periodontics include one by Kalburgi et al. (2023), which involved postgraduate students and interns but did not specify the regional scope[4], and another by Chawla et al. (2023), which was conducted among faculty members in Maharashtra rather than postgraduate students[3]. The findings of our study revealed that PG students were aware of AI applications in periodontics; however, they also indicated that limited exposure to AI during postgraduate training reduced their confidence in applying these tools in clinical practice.

In our study, 76% of respondents reported being aware of AI tools in periodontics, with the majority belonging to the third-year postgraduate group. Similar findings were noted in previous studies, where Chawla et al. (2023) reported that 62% of participants were aware of the term AI[3], and Jaideep Sur et al. (2020) found that 68% were familiar with AI applications[5]. In our study, 44% of participants were aware of sensors utilizing AI tool for halitosis detection, 14% recognized software capable of identifying implant systems from panoramic radiographs, and 34% were familiar with AI tools designed to measure periodontal pocket depth. However, only 40% demonstrated awareness of haptic-based dental simulators that replicate teeth and gingiva.

In our study, 44% of participants believed that AI would be valuable for screening and treatment planning in periodontics. Comparable findings were reported in earlier studies: Chawla et al. (2023) noted that 77% of respondents agreed that AI is useful in diagnosing periodontal bone loss[3]; Kalburgi et al. (2023) found that 73.3% believed AI could enhance clinical diagnosis[4]; and Sur Jaideep et al. (2020) reported that 87% of participants were willing to use AI for radiological diagnosis[5]. Similarly, Akhtar et al. (2022) observed that 65.3% supported the use of AI for treatment planning[6], while Karan-Romero et al. (2023) reported only 15% agreement regarding its role in treatment planning[7]. In our study, 32% also agreed that AI could serve as a quality control tool to assess treatment outcomes, a result in line with Karan-Romero et al. (2023), who reported 13% agreement[7]. Furthermore, 81% of our respondents believed that AI could assist in three-dimensional implant positioning and planning. Comparable trends were noted in prior studies, where Kalburgi et al. (2023) reported that only 18.4% were unaware of AI applications in 3D implant positioning[4], whereas Akhtar et al. (2022) found that 62% believed AI could aid in this aspect[5]. Additionally, in our study, 45% of participants felt that AI-assisted self-monitoring tools could help patients maintain oral hygiene. Moreover, in our study 29% believed that AI could aid in differentiating between chronic and aggressive forms of periodontitis, which is consistent with the findings of Chawla et al. (2023), where 87% of respondents acknowledged AI's potential in diagnosing aggressive and chronic periodontitis[3].

In our study, 32% of respondents felt that the absence of AI tools trained specifically on periodontal datasets limits their effectiveness in diagnosing periodontal diseases. 50% believed that the high cost of AI-based diagnostic systems acts as a barrier to their routine use in periodontal practice. Furthermore, 33% felt that current AI technologies are not sufficiently reliable to differentiate between various stages of periodontal disease

classification. 70% indicated that inadequate exposure to AI during postgraduate training reduces their confidence in applying such tools clinically. Additionally, 29% agreed that concerns regarding potential

misdiagnosis by AI influence their willingness to adopt AI-based tools for periodontal treatment planning and prognosis.

Our study was cost-effective and scalable, enabling prompt responses. The online format of the questionnaire also provided respondents with adequate flexibility. However, due to the relatively small sample size, the findings may differ when compared with larger population-based studies.

## V. Limitations:

Survey did not include private practitioners, under graduates, interns and faculty which might have caused potential selection bias. Closed ended questions with Likert scale might have hindered generation of various perspectives of participants. To address these constraints, future large-scale studies involving a wider range of specialists is recommended.

## VI. Conclusion:

The majority of participants were aware of the benefits of using AI in dentistry and believed it would be an asset. The study found that better technical resources in clinics and training professionals at undergraduate and postgraduate levels may help overcome future challenges towards using artificial intelligence in dentistry. This study concluded that students of postgraduation in periodontics were aware of the AI tools and benefits of AI. Study revealed the barriers to the introduction of AI clinically are lack of exposure at PG level and high cost.

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