

A Questionnaire Study on Artificial Intelligence in Periodontics

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Abstract

Background: Artificial intelligence (AI) is a set of processes designed to complete a certain goal. Some applications of Artificial Intelligence in Periodontics include the localization of soft hard deposits, illness diagnosis and prognosis, and prediction of success rates in dental implant surgery.

Methods: Given the scarcity of data on the perspectives of postgraduates and dental interns on AI, the current study was designed to assess awareness, knowledge, and attitude toward AI among postgraduate students from the Department of Periodontics and dental interns from multiple centers. A cross-sectional survey using a self-designed questionnaire containing 26 closed-ended questions was distributed via Email and WhatsApp in Google forms to 139 postgraduate students from the Department of Periodontics and 127 dental interns from various dental colleges.

Results: The questions were classified into four categories: demographic information, awareness, knowledge, and attitude. To examine the responses, the Chi-square test was used. 47.7% of the 266 respondents were dental interns, while 52.3% were postgraduate students. For dental interns and postgraduates, the average knowledge score was 7.93 and 13.04, respectively. Postgraduates' knowledge was highly significant ($P < 0.01$).

Conclusion: It has been found that the postgraduate students were more aware and knowledgeable than the dental interns. As a result, incorporating AI into academic curricula is becoming increasingly important.

Keywords: Artificial intelligence, Knowledge, Awareness, Attitude, Periodontics, Student

Introduction

Due to digitalization, our modern lifestyle has become extremely convenient. For example, because they have a home automation system, we employ tools like ALEXA and SIRI for speech interaction with the internet (1). Artificial intelligence (AI) is a term used to describe machines that do activities that need human intelligence with precision (2). AI is essentially a branch of computer science that permits the creation of software that can execute intelligent tasks (3). AI is further divided into machine learning (ML) and deep learning (DL) as sub-branches. ML is the process by which a machine solves problems

using input data and algorithms. Whereas in DL, the computer detects a hierarchy of patterns, resulting in a stronger network (4). The artificial neural network (ANN) is a fundamental AI unit composed of many neuron layers. ANN is made up of two layers: input and output, with a hidden layer in between (4,5). AI is playing an important role in the fields of medical and dentistry by distinguishing diseased from normal structures, detecting disease early, predicting treatment plan prognosis, and so on. Here comes the convolutional neural network (CNN), which can recognize images via mathematical operations (2,4,5).

In 1965, John Mc Carthy created the phrase "artificial intelligence (AI)" (6). AI has a significant impact in the field of dentistry, such as tooth recognition and accurate caries diagnosis in oral radiology (3,7). ANN is used to estimate the location of the apical foramen and to diagnose vertical root fracture. Oral cancer can be diagnosed using ANN, support machine vector (SMV), and logistic regression, among other techniques (1,4).

AI can be used in periodontics to distinguish normal from aberrant structures, detect illnesses, and predict therapy effects. It is also useful in localizing soft and hard deposits (8), predicting success rates in dental implant surgeries (9), diagnosing periodontally impaired teeth for extraction (3,6), and distinguishing periodontitis from aggressive periodontitis (10).

As one of the advancements in the field of Periodontics, it has the potential to be a promising tool as an adjunct to regular practice. As a result, the current study seeks to analyze the knowledge, awareness, and attitude of postgraduate students in the Department of Periodontics as well as dental interns from other institutions.

Methodology

Design of Study

A cross-sectional questionnaire study of postgraduates from the Department of Periodontics and dental interns was planned. The Institute's Ethical Committee granted ethical approval. Everyone is committed to provide informed online consent. To guarantee that as many respondents as possible participated, convenience sampling was used. Keeping in mind the World Medical Association Declaration of Helsinki's Ethical Principles for Medical Research Involving Human Objects, informed consent was obtained from the participants. A questionnaire in English was self-created. It had 26 closed-ended questions organized into four domains: demographic data (age, gender, and educational qualification), awareness, knowledge, and attitude. There were two age groups: 18-25 years and 25-45 years. The current study comprised both male and female participants. Periodontics postgraduate students (PPG) and dental interns (DI) from various centers were targeted. Five questions were designed to assess participants' knowledge about AI. The following 15 questions were knowledge-based, and the final six were included to examine professionals' attitudes toward the future usage of AI in dental practice.

Following the collecting of mail identifying documents and contact information from people wanting to participate in the study, a questionnaire

was made available online using Google Forms, and the link created was shared with a total of 266 participants via email/WhatsApp groups.

Statistical Analysis

The sample size was calculated using the estimations from the main article⁶, with the present knowledge level estimated to be at least 20% and a 5% confidence level, yielding a result of 246 for $P = 0.05$.

Data was compiled using a Microsoft Excel sheet (2019, Microsoft Redmond Campus, Redmond, Washington, United States) and analyzed with the statistical program Statistical Package for Social Sciences (SPSS 26.0, IBM). For categorical data, descriptive statistics included frequencies and percentages; for numerical data, mean and standard deviation. The Chi-square test was performed to compare frequencies associated to variable categories with groups. Knowledge scores were classified as 0 for incorrect responses and 1 for correct responses, and the mean knowledge score was compared using the t test between two groups. For the complete statistical test, $P < 0.05$ was considered statistically significant.

Results

Responses were collected online using Google Forms and statistically analyzed.

Demographic Data

A total of 266 people completed the questionnaire, with 52.3% being PPGs and 47.7% being DIs (Figure 1). Many participants (63.5%) were between the ages of 18 and 35. Females made up 61.3% of the participants.

Awareness about Artificial intelligence in Periodontics

The total knowledge score for dental interns was 2.72 and 4.46 for periodontics postgraduate students, as shown in (Table 1) and (Figure 2). There was a very statistically significant difference in the values between the groups ($P < 0.01$).

Figure 3 shows that the majority of the 229 students who were aware of the phrase AI (59.83%) were PPG.

Table 1. Inter group comparison of Awareness score with qualification

Qualification	N	Mean	Std. Deviation	Std. Error mean	T value	p value of T test
DIs	127	2.72	1.368	0.121	-12.662	0.000**
PPGs	139	4.46	0.836	0.071		

** High statistically significant difference ($p < 0.01$)

Table 2. Inter group comparison of Knowledge score with Qualification

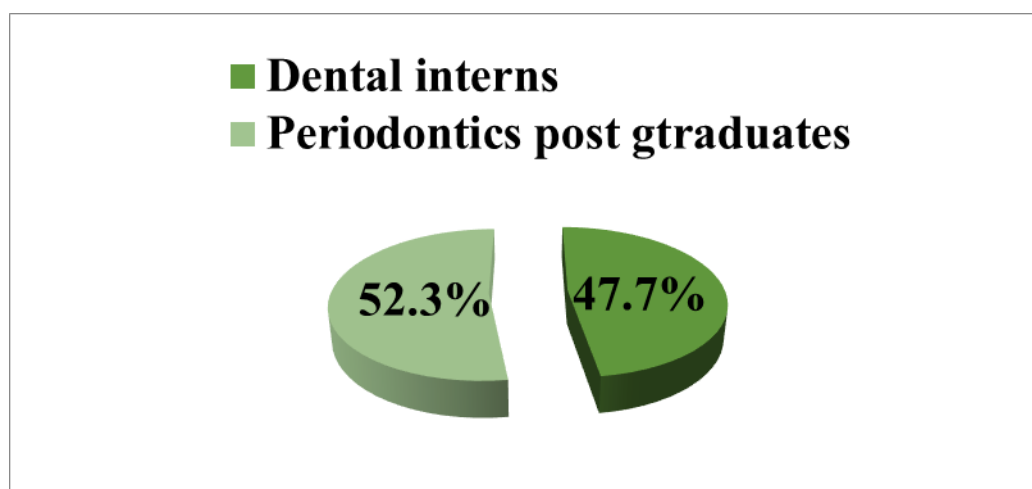
Qualification	N	Mean	Std. Deviation	Std. Error mean	T value	p value of T test
DIs	127	7.93	3.029	0.269	-17.396	0.000**
PPGs	139	13.04	1.610	0.137		

**Statistically highly significant difference ($p < 0.01$)

Table 3. Inter group comparison of Attitude score with Qualification

Qualification	N	Mean	Std. Deviation	Std. Error mean	T value	p value of T test
DIs	127	3.19	1.712	0.152	-12.542	0.000**
PPGs	139	5.27	0.897	0.076		

** High statistically significant difference ($p < 0.01$)

**Figure 1.** Distribution of students as per qualification

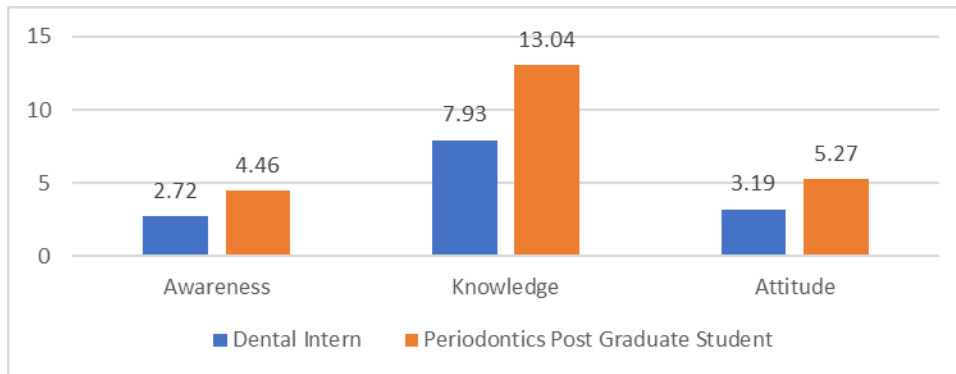


Figure 2. Intergroup comparison of numerical outcomes with Qualification

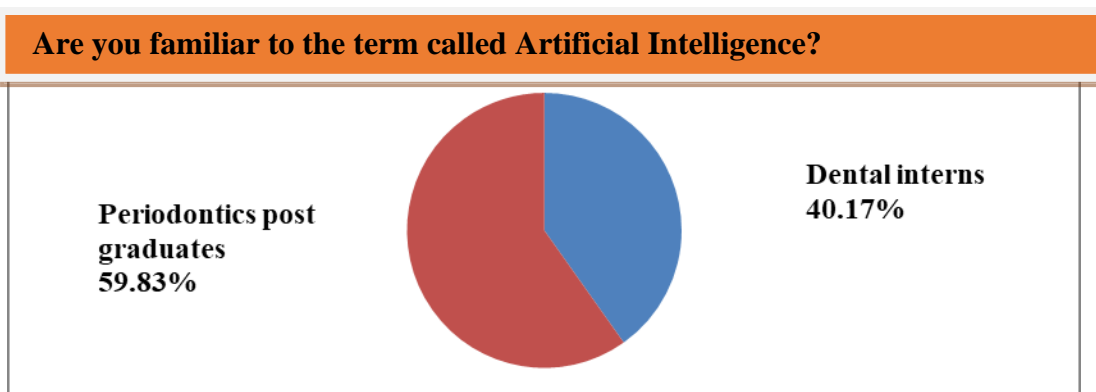


Figure 3. Distribution of students who were familiar to the term Artificial Intelligence

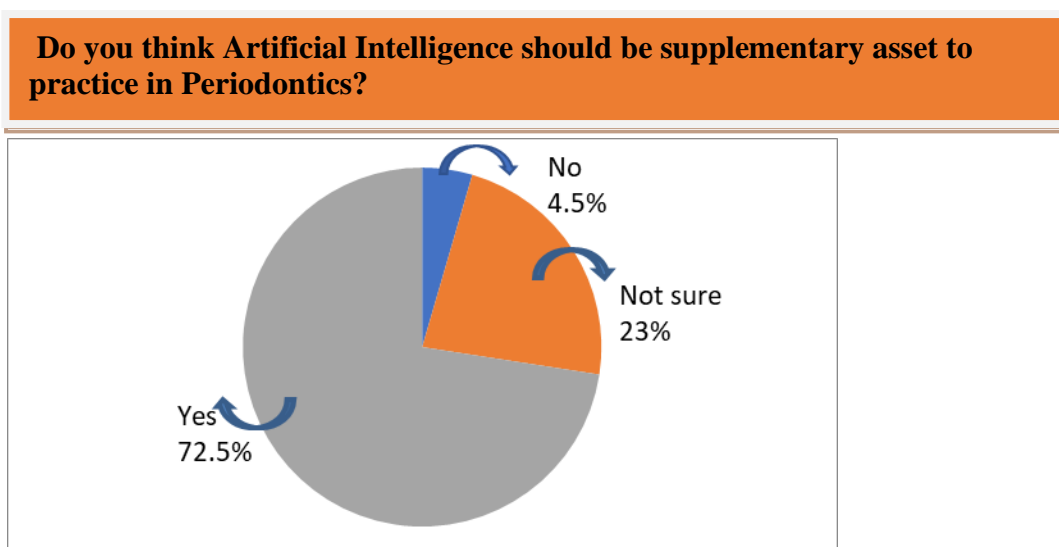


Figure 4. Students who considered AI as a supplementary asset

Knowledge about Artificial intelligence in Periodontics

The total knowledge score was 7.93 for dental interns and 13.04 for periodontics postgraduate students, as shown in Table 2 and Figure 2. A statistically significant difference in values was discovered across groups ($P < 0.01$), with postgraduates having higher values than dental interns.

Attitude towards use Artificial intelligence in Periodontics in future

Table 3 shows that postgraduates (5.27) had a higher overall score for favorable attitude about future application of AI than dental interns (3.19). There was a very statistically significant difference in the values between the groups ($P < 0.01$).

AI was known to 229 of the 266 participants (Figure 2), and its applications in Periodontics were known to 70.3%. Many of them agreed that machine learning is critical.

According to Figure 4, 72.5% of students embraced AI as a supplement to clinical experience in Periodontics.

Periodontics (76.3%). 48.8% of Dental interns, and 94.2% periodontics postgraduates showed positive response towards AI as an additional asset in Periodontics. Only 18.4% were unaware of 3D guided dental implants, whereas others (36.09%) had learned about them from the media. Many of the participants were aware of the benefits (72.6%) and drawbacks (67.3%) of AI. Only 4.5% believed that software tools could not aid in diagnosing periodontal diseases, while 73.3% agreed that AI may improve clinical diagnosis. A total of 68.4% agreed that the future of implant surgery will be simple and automated. 82.7% agree to learn AI-related tools and ethical practice utilizing AI (76.7%).

Discussion

AI is improving our daily lives in a variety of ways (1). AI is also a significant advancement in general dentistry. As we all become increasingly interested in easier ways to diagnose and treat diseases, artificial intelligence will be of immense benefit in the future practice of periodontics. Periodontal disease must be diagnosed early in this case. Early diagnosis, prognosis of damaged teeth, and precise treatment planning will be able to spare teeth from further disease development (6). Localization of deposits is a critical step in early diagnosis (8). Dental implants are one of the most significant advances in Periodontics. Navigation implant operations are difficult because we strive for perfection in implant placement (4,9). All of this will be achievable only if

AI is utilized as an auxiliary to traditional dental practice. For this goal, research in the field of artificial intelligence has taken a million-dollar turn in dentistry.

The word AI was known to 229 out of 266 participants, and its applications in Periodontics were known to many of them, with PPGs being the most numerous. One probable explanation is that AI as a recent technology has yet to be integrated in undergraduate curricula. Postgraduates also gain knowledge via research publications. However, many of them were aware of the term Artificial Intelligence. Machine learning is crucial in Periodontics, according to most of them. As many PPGs were found to be knowledgeable about AI, its branches, and its applications, most of them were aware of the usage of machine learning in Periodontics.

Almost all periodontics postgraduates responded positively to AI as an additional asset in Periodontics, whereas just half of all DI believed AI might be a supplementary asset. Given the competition in the dentistry sector, all practitioners are more interested in noninvasive, less time-consuming treatment options. As a complement, AI has the potential to have a significant impact. Most AI exercises in the domain of Periodontics were known to a large percentage of students, with a nearly equal number of PPGs and DIs. Only a tiny percentage of participants in our survey were unfamiliar with 3D guided dental implants, while others were well-versed in the subject. Articles were the most important source of information, followed by the media, seminars, and other resources. The reason for this is that as part of the study material for a postgraduate course, reading from research articles is required. Half of the dental interns said that media and other outlets were equally helpful in learning about AI. Many participants in the current study were aware of the benefits and drawbacks of AI. According to our findings, many participants feel AI may improve clinical diagnosis, while just a minority believe software tools cannot aid in the detection of periodontal diseases. In the current survey, more than half of the population believes that both digital and physical charting methods should be employed, while only a few favor purely digital historical recording and only a few accept handwritten charting as the gold standard for treatment records. In the grand scheme of things, both computerized and handwritten charting methods must be used in periodontics clinical practice. The majority of 266 students agreed that AI had a bright future in Indian dentistry practice in the coming years. Furthermore, many students agree that employing AI in dentistry is ethical. Many of the participants agreed that the future of implant surgery

will be simple and automated. Almost all of them agree to learn AI-related tools and ethical practice using AI. More than half of the females and males in our poll agreed that AI improves clinical diagnosis in periodontal disorders. All the PPGs were eager to learn AI-related tools for future use.

Seram T. and colleagues (11) conducted a survey among dentistry students and discovered comparable attitudes and perceptions regarding AI. Half of the participants believe artificial intelligence will improve treatment planning and diagnostics, according to Samyuktha P.S. and colleagues (12). As research subjects, they chose medical and healthcare employees. Furthermore, in Samyuktha P.S. and colleagues' study, many respondents chose digital data over physical data, which runs counter to our findings. In a survey of dental students, Ranjana and colleagues (13) discovered that an equal amount of girls and males believed that AI may improve clinical diagnosis.

Rieshy V and colleagues' (14) investigation produced inconsistent results. Few study participants believed that AI could constitute a threat to dental practice in terms of confidentiality and data security. Our findings on the source of information about AI contradict those of a patient survey undertaken by Jaiswal M and colleagues (15), who observed enhanced connectivity between dentists and patients via a mass media platform. According to Mupparapu and colleagues (16). AI technologies will only benefit dental practitioners by providing second perspectives that will strengthen their own. However, no technology will ever be able to replace a dental practitioner. Hwang and colleagues (17) have a roughly identical point of view. As a result, we discover that the majority of the preceding literature's conclusions are consistent with the findings of our survey in the aforementioned studies.

Our study was scalable, cost effective, and provided results quickly. It also made it simple to contact individuals and receive prompt responses from them. The anonymity of the participants was protected throughout. The online format of the questionnaire provided adequate flexibility in terms of when and where respondents may complete our survey. One of the benefits of online questionnaire surveys was its design flexibility.

Only interns and postgraduates from the Department of Periodontics are participating in this study. Because the sample size is lower, the results may change when compared to a large population study. One of the disadvantages of a selection bias is the exclusion of dental practitioners. To prevent sample bias, random sampling would have been a better alternative. Differences in comprehension and interpretation, questionnaire weariness, and

accessibility challenges may all be disadvantages. To overcome constraints, a large-scale investigation with additional specialists should be done.

Conclusion

The current study analyzed dental interns' and periodontics postgraduates' awareness, knowledge, and attitudes toward potential AI uses. The majority of the study's participants were aware of the use of AI in the field of dentistry. Because many of the kids will be future academicians, they should try to raise awareness about it. Because AI can be a useful addition in dentistry, professionals should make the final diagnosis. As an auxiliary to traditional dental practice, AI will be a promising tool. As a result, the incorporation of fundamental AI principles into dentistry curricula via lectures and seminars appears to be required. Along with the implementation of AI, this could lead to improved clinical practice and the expansion of dentistry.

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