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Original article

Analyzing Awareness and Knowledge of Artificial Intelligences Potential Application in Prosthodontics and Clinical Dentistry

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Abstract

Artificial intelligence (AI) has seen a surge in utilization in dentistry and medicine in recent years. Deep learning algorithms have outperformed clinicians in accuracy and efficiency when it comes to prosthodontic diagnosis. The aim of this study was to collect information regarding the knowledge and opinions of physicians and students regarding artificial intelligence (AI). Dentistry professionals were asked to respond to a 14-item survey regarding their use of AI in clinical settings. A cross-sectional online survey was conducted among experienced dentists and undergraduate students from various dental medicine institutions in Tripoli (n = 402) to assess current perceptions and grasps of AI in practice. Statistical analysis was performed with SPSS 20®1, Graph Pad Prism®1, and Microsoft Excel 20163. All qualitative data were presented as frequency & percentages, all comparisons were performed by using the Chi square test. There was a notable variation in the responses given that 50.7% of participants are aware of healthcare equipment powered by AI, and 38.8% think AI may be used to diagnose soft tissue lesions. 52.7% believe in AI's ability to learn from successful crown designs. 52.2% of respondents think AI can be applied to implant detection. 51% of people think AI can be utilized in caries diagnosis. Compared to females, males exhibit higher levels of awareness (61.9%). The study's conclusions indicate that Tripoli's dental practitioners are fairly knowledgeable about artificial intelligence in dentistry. Nonetheless, a great deal of positivety outweighs the use of artificial intelligence in dentistry. To improve professional and student preparedness, and hence, expand AI integration in practice, more work needs to be done in this area. Participants who are male are more upbeat and self-assured about AI in dentistry.

Keywords: *Artificial Intelligence, Clinicians, Survey, Perception, Dentists, Dental Students, Crown.*

Introduction

Artificial intelligence (AI), one of the most significant achievements of the current industrial revolution, enters an entirely novel digital era. As more and more electronic devices become a part of everyday life, the data they record enables artificial intelligence (AI) to comfortably use and analyze the information they produce. In all industries, AI is booming and increasing quickly. It can execute tasks that generally require intelligence from humans and learn from their experience. The definition of artificial intelligence (AI), which was developed by John McCarthy in 1956, is "a category of science and engineering concerned with the machine recognizing what's typically referred to as intelligent action, and with the development of items that reflect such behaviour [1]. Artificial intelligence (AI) is defined as a computer's capacity to display a kind of its own intelligence. Here, the goal was to create machines that could use knowledge for learning and resolving issues .AI includes machine learning, which uses algorithms for predicting results from a collection of data. Machine learning enables computers to learn from knowledge so they can fix problems without human involvement [2]. A group of algorithms called neural networks utilize artificial neurons to compute signals. Making neural networks that operate like the human brain is the ultimate objective of neural networks [3].

Deep learning is a branch of machine learning that uses a type of deep neural network with multiple computational layers to interpret incoming data. Deep learning aims to build a neural network that recognizes patterns automatically to enhance feature recognition [3].

AI applications in diverse areas involve expert systems, game play, image recognition, natural language processing, robotics, and theorem-proving in telecommunication and aerospace. In the last decade, technological breakthroughs have also resulted in considerable improvements in both dentistry and medicine. By adopting AI, dental healthcare providers

may minimize workload and the need for additional staff, making it a vital tool in the field [5].

The assessment and decision-making processes are probably where AI in dentistry has the biggest impact. Numerous studies have demonstrated that AI systems can quickly combine patient data and produce a useful output that aids the dentist in making their ultimate diagnosis and treatment plan [6]. For a dentist, preparing a tooth for crowns and bridges is a common task, although it is nevertheless difficult even with years of practice. The difficult part is minimizing the amount of damage to healthy tooth structure while still reducing the tooth enough to make room for the prosthetic repair. The subsequent hardware elements were listed in Yuan et al.'s description of a robotic tooth preparation system :(a) an intraoral 3D scanner (TRIOS, 3Shape A/S, Copenhagen, Denmark) to obtain the three-dimensional data of the patient's target tooth, adjacent teeth, opposing teeth, and the teeth fixture; (b) CAD/CAM software to design the target preparation shape and generate a 3D motion path of the laser; (c) an efficient low-heat laser appropriate for hard tissue preparation; (d) robot arm; and (e) a tooth fixture connecting the robot arm and the target tooth and protecting the adjacent teeth from laser cutting [7]. In addition, the accuracy of different dental preparation tools was examined. The preparation accuracy of a system using micro robots and a picosecond laser met clinical requirements; the inaccuracy was about (0.089 ± 0.026) mm [8, 9]. In a study comparing (human-) hand crown prep with a different tooth preparation technique for veneers, which used a rotating diamond instrument attached to a robotic arm, the second method produced superior outcomes. Approximately 40 m were a system's average repeatability [10,11]. Several types of AI are now starting to influence dentistry, such as enhancing images for radiology, the diagnosis of periapical lesions and the determination of root anatomy for endodontics [12], the assessment of cysts and tumours [13] the identification of periodontitis [14], as well as the computerized positioning of cephalometric landmarks in orthodontics [15] In the field of removable prosthodontics, it can be achieved to estimate the changes of facial soft tissue that will occur in patients after complete denture services with AI systems quickly and accurately [16]. Although it still requires additional research, AI can design case-specific removable partial prosthetics[17].

Indeed, AI has a vast potential to revolutionize the field of prosthodontics. Machine learning algorithms can analyze patient data and predict the best treatment plan for each individual patient based on their unique needs and conditions. For example, AI can be used to design and fabricate customized dental prostheses such as crowns, bridges, and dentures that perfectly fit a patient's mouth and function optimally, this is particularly important in cases where patients have unique or complex dental structures that require a more personalized approach. AI can also aid in implant surgery [18].

AI might help with precise color matching in difficult aesthetic circumstances involving a single central incisor or several front teeth. In implant prosthodontics, implant locations may be identified with the use of intraoral detectors, and this information can then be inputted into the CAD program in real-time. AI has the capacity to improve dental implant design and fabrication [12].

Few studies have examined the perceptions of density and dentistry students, in contrast to the great majority of AI research, which focuses on designing and testing AI algorithms and their associated prediction models, since there is little question that the use of AI in healthcare practice and education will continue to grow, it is evident that this lack of knowledge exists across the field and needs to be addressed. Thus, it is essential to successfully integrate AI into dentistry to comprehend the attitudes and behaviors of dentists as end users of existing and future AI applications. Additionally, assessing dentists' proficiency with AI is critical to deciding whether further training will eventually be required, given that they frequently contact patients and use technology. The current study aimed to assess the knowledge, attitude and willingness of dentists and dentistry students and their organizational readiness to integrate AI into dentistry.

Methods

Study design

This was a cross-sectional questionnaire-based study conducted among dental students (undergraduates and postgraduates) and dental professionals (faculties and practitioners) to assess their knowledge and benefits of artificial intelligence and its potential applications in the fields of oral medicine and diagnosis based on their level of education. A cross-sectional study with 402 participants was conducted to examine dentists' knowledge and awareness of the application of artificial intelligence in oral health dentistry. After explaining the goal

of the study to the participant's, informed consent was obtained. The study's sample approach is a simple random sampling procedure. The questions were created and distributed using online Google Forms to Tripoli dentists and students. The questionnaire was designed with two sections: The first section includes questions about participants' demographic information, such as gender and degree of education. The second section of the questionnaire included 12 items with a 'yes,' 'no,' and 'may be' pattern. The questionnaire's reliability and validity were evaluated. Before beginning the investigation, encounter validity was further evaluated.

Sample size calculation

According to the results of a previous study [19] in which the prevalence was (85.8%)- by adopting a confidence interval of (99%), a margin of error of (5%) with finite population correction; The minimal accepted sample size is (323) cases. Sample size was calculated by using EPI INFO version 7.2.5.0.

Statistical analysis

Statistical analysis was performed with SPSS 20®1 , Graph Pad Prism®1, and Microsoft Excel 20163. All qualitative data were presented as frequency & percentages, all comparisons were performed by using the Chi square test.

Results

Demographic data

In this study, a data set of responses from 402 dental students and dentists were analyzed. The demographic data of all responses were presented in table 1.

Gender distribution: females show (71.9%) outnumbering males (28.1%) by a large margin.

Table 1. Frequency and percentages of demographic data among all participants

Variables		Count	Column N %
Gender	**Male**	113	28.1%
	Female	289	71.9%
Scientific status (Work placement)	First year dental student	21	5.2%
	Second year dental student	32	8.0%
	Third year dental student	19	4.7%
	Fourth year dental student	70	17.4%
	Interns	78	19.4%
	Dental faculties	50	12.4%
	Dental officers	132	32.8%

Participant categories

The table presents seven different categories of participants. Dental officers: This group represents the largest portion of participants at 32.8%. Student representation: Across all years, dental students make up 35.3% of the sample, with fourth-year students being the most numerous (17.4%). Interns: This group constitutes 19.4% of the sample, while dental faculties revealed 12.4%.

Participant attitudes about AI

AI Awareness: there was a significant difference between answers (P<0.001), as 50.7% of participants are aware of AI-driven healthcare devices, while 35.8% are uncertain. Only 13.4% are unaware, indicating a generally good level of AI awareness in the field.(table2)

AI Familiarity: Similarly, there was a significant difference between answers (P<0.001), as 49% are familiar with AI concepts and uses, 35.1% are unsure, and 15.9% are unfamiliar.

Willingness to Use AI: there was a significant difference between answers (P<0.001), as majority (53%) are open to using AI software in dentistry, with 39.1% uncertain and only 8% unwilling.

Diagnostic Capabilities: Participants are cautiously optimistic about AI's diagnostic abilities, there was a significant difference between answers (P<0.001), as 40.8% believing AI can establish definite diagnoses and 47.8% uncertain.

Specific Applications: Soft tissue lesions: there was a significant difference between answers (P<0.001), as 38.8% believe AI can be used, 51.5% are uncertain. In Implant detection there was a significant difference between answers (P<0.001), as 52.2% believe AI can be used, 39.1% are uncertain. In caries diagnosis there was a significant difference between answers (P<0.001), as 51% believe AI can be used, 39.3% are uncertain.
Perceived Benefits: there was a significant difference between answers (P<0.001), as 41% recognize multiple benefits of AI, including fast data delivery, lack of limitations, and error reduction.
Clinical Decision Making: there was a significant difference between answers (P<0.001), as 43% believe AI helps in clinical decision-making, while 45% are uncertain.
Doctor-Patient Relationships: there was a significant difference between answers (P<0.001), as Opinions are mixed, with 53.2% agreeing AI has improved these relationships, 31.4% disagreeing, and 15.4% neutral.
Learning Capabilities: there was a significant difference between answers (P<0.001), as 52.7% believe in AI's ability to learn from successful crown designs.
Most Useful Application: there was a significant difference between answers (P<0.001), as 50% think AI will be most useful in diagnosis, followed by direct treatment (27.6%) and treatment decisions (22.4%).

Table 2. Participants attitude about AI

Participant attitudes about AI		**N**	**%**	**P value**
Are you aware of Artificial intelligence (AI) driven health care devices	no	54	13.4%	<0.0001*
	yes	204	50.7%	
	may be	144	35.8%	
Are you familiar with the concept of AI and it's use	no	64	15.9%	<0.0001*
	yes	197	49.0%	
	may be	141	35.1%	
Would you like to use a software/ program that can be helpful in dentistry	no	32	8.0%	<0.0001*
	yes	213	53.0%	
	may be	157	39.1%	
Can AI establish a definite diagnosis	no	46	11.4%	<0.0001*
	yes	164	40.8%	
	may be	192	47.8%	
AI can be used in the diagnosis of soft tissue lesions of the mouth	no	39	9.7%	<0.0001*
	yes	156	38.8%	
	may be	207	51.5%	
AI can be used in implant dentistry to detect implant types from periapical and panoramic radiographs	no	35	8.7%	<0.0001*
	yes	210	52.2%	
	may be	157	39.1%	
Can AI be used for radiographic diagnosis of tooth caries	no	39	9.7%	<0.0001*
	yes	205	51.0%	
	may be	158	39.3%	
What are the benefits of using AI in your opinion	Large-scale, fast, and high-quality clinical data delivery is a capability of AI.	64	15.9%	<0.0001*
	There are no physical or emotional limitations for AI.	50	12.4%	
	AI can speed up processes in healthcare and reduce medical errors	123	30.6%	
	All the above	165	41.0%	
Does AI help in clinical decision making	no	48	11.9%	<0.0001*

	yes	173	43.0%	
	may be	181	45.0%	
Has AI improved doctor patient relationships	Strongly agreed	47	11.7%	<0.0001*
	Agreed	167	41.5%	
	Neutral	62	15.4%	
	Strongly disagree	20	5.0%	
	Disagree	106	26.4%	
AI is its ability to analyze and learn from the millions of doctor-approved crowns in the database to o learn from successful crown designs	no	38	9.5%	<0.0001*
	yes	212	52.7%	
	may be	152	37.8%	
In which field of dentistry do you think AI will be most useful	Direct treatment	111	27.6%	<0.0001*
	Making a diagnosis	201	50.0%	
	Making treatment decisions	90	22.4%	

Association between attitude and gender

Awareness of AI-driven healthcare devices: Males show higher awareness (61.9% yes) compared to females (46.4% yes). Females are more uncertain (40.1% may be) than males (24.8% may be). The difference is statistically significant (p=0.01).(table3)

Familiarity with AI concepts: Males report higher familiarity (60.2% yes) than females (44.6% yes). Females show more uncertainty (38.8% may be) compared to males (25.7% may be). Statistically significant difference (p=0.01).

Willingness to use AI software in dentistry: Males are more willing (61.9% yes) than females (49.5% yes). Females are more uncertain (43.6% may be) than males (27.4% may be). Significant difference (p=0.01).

AI's ability to establish definite diagnosis: Males are more confident (55.8% yes) compared to females (34.9% yes). Females are more uncertain (52.2% may be) than males (36.3% may be). Highly significant difference (p=0.001).

AI in soft tissue lesion diagnosis: Males show more confidence (48.7% yes) than females (34.9% yes). Females are slightly more uncertain (53.3% may be vs. 46.9% for males). Significant difference (p=0.01).

AI in implant dentistry: Males show higher confidence (63.7% yes) compared to females (47.8% yes). Females are more uncertain (44.6% may be vs. 24.8% for males). Highly significant difference (p=0.001).

AI in radiographic diagnosis of tooth caries: Males show higher confidence (59.3% yes) than females (47.8% yes). Females are more uncertain (43.6% may be vs. 28.3% for males). Significant difference (p=0.01).

Benefits of using AI: No significant gender difference (p=0.28). Both genders recognize multiple benefits (44.2% males, 39.8% females for "All the above").

AI in clinical decision making: Males are more confident (53.1% yes) than females (39.1% yes). Females are more uncertain (48.1% may be vs. 37.2% for males). Significant difference (p=0.03).

AI's impact on doctor-patient relationships: Males are more positive (62.8% strongly agree/agree) than females (49.4% strongly agree/agree). Females are more negative (32.9% disagree/strongly disagree) than males (27.4% disagree/strongly disagree). Significant difference (p=0.002).

AI's ability to learn from crown designs: Males show higher confidence (64.6% yes) than females (48.1% yes). Females are more uncertain (42.6% may be vs. 25.7% for males). Significant difference (p=0.006).

Most useful field for AI in dentistry: No significant gender difference (p=0.62). Both genders favor diagnosis (50.4% males, 49.8% females).

Table 3. Distribution of participants attitude about AI among gender

		Gender				Chi-Square Tests	
		Male		Female			
		Count	Column N %	Count	Column N %	Chi-square	P value
Are you aware of AI driven health care devices	no	15	13.3%	39	13.5%	9.23	0.01*
	yes	70	61.9%	134	46.4%		
	may be	28	24.8%	116	40.1%		
Are you familiar with the concept of AI and it's use	no	16	14.2%	48	16.6%	8.27	0.01*
	yes	68	60.2%	129	44.6%		
	may be	29	25.7%	112	38.8%		
Would you like to use a software/ program that can be helpful in dentistry	no	12	10.6%	20	6.9%	9.21	0.01*
	yes	70	61.9%	143	49.5%		
	may be	31	27.4%	126	43.6%		
Can AI establish a definite diagnosis	no	9	8.0%	37	12.8%	14.62	0.001*
	yes	63	55.8%	101	34.9%		
	may be	41	36.3%	151	52.2%		
AI can be used in the diagnosis of soft tissue lesions of the mouth	no	5	4.4%	34	11.8%	9.09	0.01*
	yes	55	48.7%	101	34.9%		
	may be	53	46.9%	154	53.3%		
AI can be used in implant dentistry to detect implant types from periapical and panoramic radiographs	no	13	11.5%	22	7.6%	13.58	0.001*
	yes	72	63.7%	138	47.8%		
	may be	28	24.8%	129	44.6%		
Can AI be used for radiographic diagnosis of tooth caries	no	14	12.4%	25	8.7%	8.12	0.01*
	yes	67	59.3%	138	47.8%		
	may be	32	28.3%	126	43.6%		
What are the benefits of using AI in your opinion	Large-scale, fast, and high-quality clinical data delivery is a capability of AI.	22	19.5%	42	14.5%	3.77	0.28
	There are no physical or emotional limitations for AI.	10	8.8%	40	13.8%		
	AI can speed up processes in healthcare and reduce medical errors	31	27.4%	92	31.8%		
	All the above	50	44.2%	115	39.8%		
Does AI help in clinical decision making	no	11	9.7%	37	12.8%	6.49	0.03*
	yes	60	53.1%	113	39.1%		
	may be	42	37.2%	139	48.1%		
Has AI improved doctor patient relationships	Strongly agreed	20	17.7%	27	9.3%	16.99	0.002*
	Agreed	51	45.1%	116	40.1%		
	Neutral	11	9.7%	51	17.6%		
	Strongly disagree	10	8.8%	10	3.5%		

	Disagree	21	18.6%	85	29.4%		
AI is its ability to analyze and learn from the millions of doctor-approved crowns in the database to o learn from successful crown designs	no	11	9.7%	27	9.3%	10.34	0.006*
	yes	73	64.6%	139	48.1%		
	may be	29	25.7%	123	42.6%		
In which field of dentistry do you think AI will be most useful	Direct treatment	34	30.1%	77	26.6%	0.95	0.62
	Making a diagnosis	57	50.4%	144	49.8%		
	Making treatment decisions	22	19.5%	68	23.5%		

Association between attitude and scientific status

Awareness of AI-driven healthcare devices: Awareness increases with academic progression, from 33.3% in first-year students to 68-69% in interns and dental faculty. Dental officers show lower awareness (35.6%) compared to more advanced students and faculty. The difference is statistically significant (p=0.01).(Fiqure1)

Familiarity with AI concepts: Similar trend to awareness, with familiarity increasing from 33.3% in first-year students to 76% in dental faculty. Dental officers again show lower familiarity (35.6%). Statistically significant difference (p=0.01).

Benefits of using AI: No statistically significant difference across groups (p=0.28). More advanced students and faculty tend to recognize multiple benefits more often.

Willingness to use AI software in dentistry: Willingness generally increases with academic progression, peaking at 77.1% for fourth-year students. Dental officers show lower willingness (31.8%) compared to other groups. Significant difference (p=0.01).

AI in clinical decision making: Belief in AI's help increases with academic progression, from 23.8% in first-year students to 66% in dental faculty. Dental officers show lower confidence (29.5%). Significant difference (p=0.03).

AI's impact on doctor-patient relationships: Mixed opinions across groups, with dental faculty being most positive (76% agree/strongly agree). First-year students and dental officers are most skeptical. Significant difference (p=0.002).

AI's ability to establish a definite diagnosis: Confidence generally increases with academic progression, peaking at 70% for dental faculty. Dental officers show lower confidence (28.8%). Highly significant difference (p=0.001).

AI in diagnosing soft tissue lesions: Confidence increases with academic progression, peaking at 68% for dental faculty. Dental officers show lower confidence (28.8%). Significant difference (p=0.01).

AI in implant dentistry: Confidence generally increases with academic progression, peaking at 78% for dental faculty. Dental officers show lower confidence (32.6%). Highly significant difference (p=0.001).

AI in radiographic diagnosis of tooth caries: Confidence increases with academic progression, peaking at 68% for dental faculty. Dental officers show lower confidence (29.5%). Significant difference (p=0.01).

AI's ability to learn from crown designs: Confidence generally increases with academic progression, peaking at 78% for dental faculty. Dental officers show lower confidence (30.3%). Significant difference (p=0.006).

Most useful field for AI in dentistry: No significant difference across groups (p=0.62). Making a diagnosis is the most popular choice across all groups, especially among dental officers (61.4%).

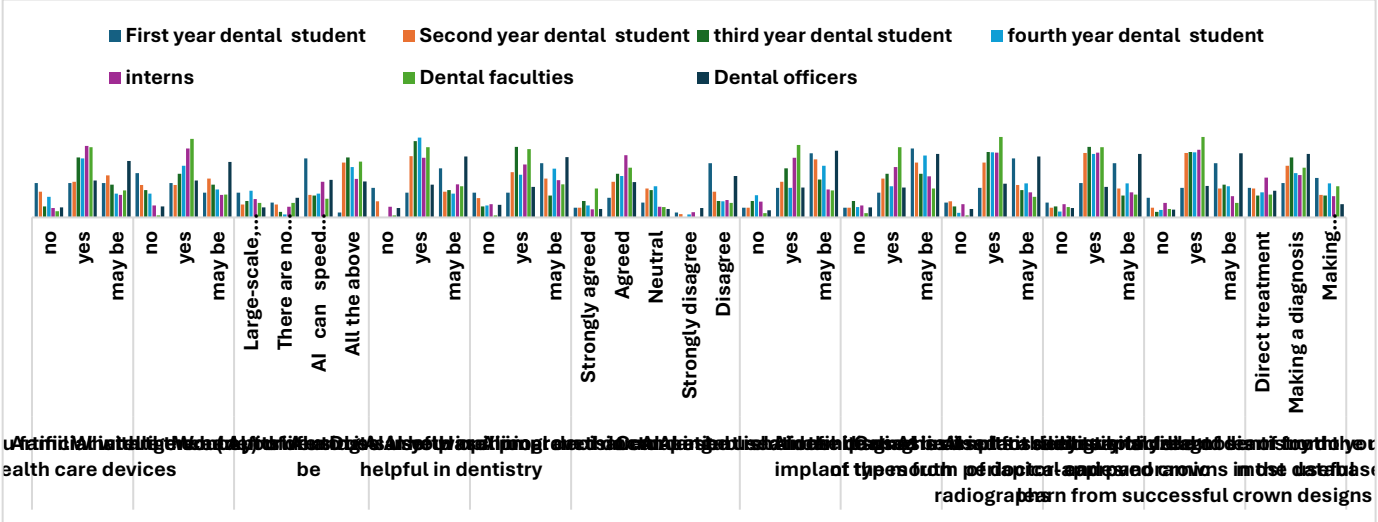

Figure 1. Association between attitude and scientific status

Discussion

This study aimed to assess the perceptions and uses of artificial intelligence held by dentistry professionals and students in Tripoli. Students studying dentistry comprise 32.8%. of the sample overall, with the largest number (17.4%). being fourth-year students. 12.4% of the sample is made up of dental faculties, compared to 19.4% of interns. Out of the participants, 35.8% are unsure and 50.7% are aware of AI-driven healthcare equipment. Our findings are somewhat comparable to those of Saudi Arabia [20] and Turkey [21], which reported that 48.4% of their respondents had a basic understanding of AI. Only 13.4% are clueless, demonstrating a generally good degree of AI awareness in the field. While Our results were lower than previous studies conducted in central India (68%) [22] and North India (55.8%–77.4%) [23].

49% of survey respondents were familiar with AI dental applications, 15.9% are unfamiliar. This is contradicting with other findings were seen among German dentists, of whom the majority said they knew only medium amounts of information regarding AI, with only 6.3% saying they knew it very well [24].

Of those surveyed for our study, 40.8% believe AI will be most helpful for diagnosis, with direct treatment coming in second at 43% believe AI helps in clinical decision-making. Over 500 AI-enabled medical devices, mostly in the radiology industry, were approved by the FDA in 2022, according to its most recent report [25]. The FDA approved VideaHealth's AI algorithm for the dental field, which has been shown in clinical trials to reduce the rate of missed cavities by over 40% and the rate of incorrect caries diagnoses by approximately 15%; Overjet's Dental Assist software, which uses deep learning AI to automatically measure bone loss in X-rays, reducing the time it takes for dentists to diagnose and treat periodontal disease; and Pearl's Second Opinion solution, which uses computer vision AI to identify conditions. cavities, tartar, and inflammation, as well as highlighting root canals, crowns, fillings, bridges, and implants. Though authors have stressed that there are no defined best practices for the evaluation of commercially accessible algorithms to assure their reliability and safety, the FDA's regulatory methods have recently come under scrutiny. The authors deduced, based on data on FDA-approved devices that is readily available to the public, that nearly all AI devices that have been approved have only undergone retrospective studies, and a significant percentage of approved devices have only been evaluated at a small number of sites, indicating limited geographic diversity [26].

According to our study, 38.8% of respondents concur that artificial intelligence (AI) can be utilized to diagnose soft tissue abnormalities in the mouth. Zhou et al.'s study from 2023 [27] evaluated CNNs' ability to use clinical images for automated classification and detection of recurrent aphthous ulcers (RAU), frequently occurring disorders of the oral mucosa, and healthy oral mucosa. With an accuracy of 92.86 percent, the pretrained ResNet50 network fared remarkably well in the classification procedure. The model with the highest accuracy, YOLOV5, had results that were 98.70%. Better accuracy and sufficient future potential were shown in the classification and diagnosis of RAU lesions through nonintrusive oral photos utilizing the previously developed ResNet50 and YOLOV5 algorithms.

In 2023, Keser et al. [28] conducted research to develop a deep learning approach for identifying OLP lesions in images. An AI system properly categorized every experimental photo

with 100% accuracy. The preliminary results show that AI is capable of handling this significant issue. Furthermore, Natarajan et al.'s work [29] looked at the application and study of DL approaches based on AI for the diagnosis of herpes simplex.

AI can be utilized in implant dentistry to identify different types of implants using panoramic and periapical radiographs; in our survey, 52.2% of participants thought AI was employed for implant detection. AI has also been applied to implant dentistry to forecast success and stability rates. Convolutional neural networks (CNNs) based on AI were used to categorize implants using panoramic and periapical radiography in a study by Lee J et al., [30]. The results of the study show that the AI-CNN system performs nearly as well as humans in classifying implant procedures.In order to successfully install implants, bone amount and quality have also been detected using AI algorithms. Clinicians can identify areas of possible bone loss or pathology and acquire more precise measures by applying AI to evaluate CBCT pictures [31]. AI algorithms are able to forecast the likelihood of an implant succeeding by examining patient data along with variables like diameter, length, and bone density [32]. This can give patients more precise information about the possible results of their therapy and assist clinicians in making more educated judgments when planning implant treatments. Treatment planning, implant positioning, and overall success rates could all be enhanced by the application of AI in implant dentistry. AI systems can give doctors insightful information that can improve medical outcomes by evaluating patient data and picture data.

AI should, however, be utilized as a tool to support physicians rather than as a substitute for their knowledge and judgment [33].Digital technology has completely changed the field of implantology by enabling accurate prosthesis design and manufacture, as well as the planning and placement of implants. Using digital planning software, physicians can generate a virtual surgical guide to assist with implant placement during surgery. The physical surgical guide, which can be utilized during surgery to guarantee precise implant placement, can then be made using rapid prototyping technology. With this method, implant placement may be done with more accuracy and precision, which lowers the possibility of problems and raises the success rate overall. Overall, the discipline of prosthodontics and implantology has changed as a result of the use of digital technology, which makes treatment planning and execution more precise, accurate, and customized [34].

In our study 51% think Is AI capable of diagnosing dental cavities using radiography. Pearl, a cutting-edge AI-powered dental radiograph interpretation tool, is transforming the area of dental diagnostics. While other AI technologies are now being used or developed for dental caries detection, Pearl is leading the way. By introducing uniformity and precision to improve diagnostic accuracy and standardization across dental offices, Pearl reduces these hazards [35]. Pearl's powerful deep learning model, which was trained on a wide variety of dental radiographs, is the core of Pearl's capabilities.

Several dental diseases, such as dental caries, periodontal bone loss, and periapical lesions, are among those that the tool can recognize and annotate. Pearl provides an invaluable second set of eyes for the dentist by identifying these common dental diseases, ensuring that no small detail is missed [36]. Pearl is not a substitute for a dentist's clinical judgment, even though it can help with diagnosis. Instead of being a stand-alone diagnosis system, the tool should be used to support dental practitioners [37]. Overjet is a cutting-edge diagnostic tool for dentistry that interprets dental images using cutting-edge AI technology. By providing increased consistency, accuracy, and efficiency in the study and interpretation of dental radiographs, this amazing technology revolutionizes dental care. Furthermore, Overjet's AI-driven technology brings precision and standardization that can considerably improve diagnostic accuracy and consistency across dental offices, hence reducing this variability. Overjet's novel deep learning algorithms, which were trained on a sizable library of dental radiographs, are the foundation of its efficacy [38]. With the use of these algorithms, Overjet is able to recognize and annotate a variety of common dental diseases, such as periodontal disease and dental caries. Therefore, Overjet can provide as a very trustworthy second opinion for the dentist, making sure that no information is missed [39].

52.7% of respondents think AI can learn from successful crown designs because of its capacity to examine and absorb knowledge from the millions of doctor-approved crowns stored in the database. In prosthetic dentistry, the use of intraoral scanners, CAD/CAM, and AI has completely changed the process of creating and designing dental restorations. The procedure is now less labor-intensive, quicker, and more accurate thanks to these developments. The overall quality of the restorations has increased as a result of the application of AI in margin detection and prosthesis design.

AI and CAD/CAM integration enables prostheses to be tailored to the specific requirements of each patient, improving both appearance and functionality. Furthermore, the design and

production of removable dentures has benefited from the use of AI and CAD/CAM technologies, which has shortened recovery times for patients overall, decreased human error, and simplified laboratory procedures [40]. But as digital tools and technology have advanced, smile designs are now made with the aid of computer software, enabling more exact and accurate planning. Patients now get more aesthetically pleasant and predictable results. Dental practitioners can alter every element of a patient's smile with virtual smile design software, including the color, position, and size of their teeth. This personalization aids in the creation of a distinctive grin that complements the patient's characteristics and disposition [41].

The information used in our inquiry reveals a clear trend: attitudes towards AI in dentistry generally become more positive and confident as academic and professional status increases, with dental faculty typically showing the most positive attitudes. However, there's a notable exception with dental officers, who consistently show lower levels of awareness, familiarity, and confidence in AI applications compared to more advanced students and faculty.

In our study, the data consistently shows that male participants have more positive and confident attitudes towards AI in dentistry, while females tend to be more uncertain. These gender differences are statistically significant in most aspects, suggesting a potential gender gap in AI perception and acceptance in the dental field. This could be due to various factors such as exposure, education, or inherent biases, and may indicate a need for targeted education and awareness programs to bridge this gap.

Conclusion

Dental professionals in Ttripoli have a good level of understanding regarding AI in dentistry. However, the application of artificial intelligence in the dentistry area is surpassed by a high degree of positivity. Participants who are male are more upbeat and self-assured about AI in dentistry.Nevertheless, there is a need for AI to receive more attention in dental education by including the topic in undergraduate, postgraduate, research papers, articles, and lectures on artificial intelligence in dentistry could help to raise awareness among dental students.

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