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AWARENESS OF ARTIFICIAL INTELLIGENCE IN PROSTHODONTICS

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Abstract

The integration of Artificial Intelligence (AI) in prosthodontics represents a transformative advancement in dental care, offering unprecedented precision, efficiency, and personalized treatment. This study aims to evaluate the current level of awareness and understanding of AI applications within the field of prosthodontics among dental professionals. It explores how AI technologies, such as machine learning, computer vision, and robotic systems, are being utilized to enhance diagnostic accuracy, treatment planning, and the fabrication of dental prostheses. Through a comprehensive literature review and a survey conducted among prosthodontists, this research identifies the key benefits and challenges associated with AI adoption. It also highlights the need for ongoing education and training to ensure that dental practitioners are well-equipped to harness the full potential of AI. By fostering greater awareness and knowledge of AI capabilities, this study seeks to pave the way for improved patient outcomes and the future advancement of prosthodontic practices.

Keywords: Artificial Intelligence (AI), Prosthodontics, Dental Care, Machine Learning, Computer Vision, Robotic Systems.

Introduction

The field of dentistry has recently seen a spectacular surge in popularity, mostly attributable to the wealth of scientific study and technological developments. These advances have revolutionised dentistry by enhancing diagnostic tools and treatment approaches. Ultimately, they have led to better patient outcomes and higher quality care overall.1 The innovative field of artificial intelligence (AI) has seen rapid adoption in the dental business. Algorithms and machine learning approaches may teach computers to mimic human decision-making, pattern-recognition, and problem-solving abilities. The term for this kind of technology is AI.

The dental practice stands to gain a great deal from artificial intelligence's capacity to enhance clinical operations, treatment planning, and patient care.Dentistry practices could benefit from data analytics and AI to make better use of their patients' massive data collections. Better clinical outcome prediction, individualised treatment plans, and groundbreaking discoveries may all be built upon this. Better prevention, earlier diagnosis of oral health disorders, and more tailored treatment are all possible outcomes of AI's application.

Some branches of dentistry, including prosthodontics and cosmetic dentistry, could be radically altered by the advent of artificial intelligence (AI). Patients' confidence and well-being may benefit from cosmetic dentistry because of the dentists' efforts to improve the smile's visual appeal. On the flip side, prosthodontists are well-versed in the use of prostheses like implants, bridges, and crowns to repair and replace teeth, gums, and other supporting tissues in the mouth.

Cosmetic dental operations such as smile design, veneer implantation, and teeth whitening might be enhanced using software driven by artificial intelligence (AI). Algorithms driven by artificial intelligence may analyse a patient's facial characteristics, dental morphology, and gingival contours to create a virtual treatment plan that is specific to their aesthetic goals and limitations. In addition, physicians can ensure the grin is balanced, proportional, and harmonic

using picture analysis technology powered by artificial intelligence—which might lead to the most lifelike outcomes.

Similarly, artificial intelligence is bringing about a dramatic shift in prosthodontics by allowing for the efficient and accurate production of personalised prosthetic restorations. A significant decrease in manufacturing time and mistakes may be achieved by quickly prototyping dental prosthesis utilising AI algorithms connected with CAD and CAM systems. By taking biomechanical characteristics, aesthetics, and durability into account, AI-powered prediction models may one day lead to better prosthetic material choices.

Inconsistent acceptance and implementation of AI into the dentistry industry has been a major setback, considering the immense promise of AI. There is a divide because dental professionals are worried about data privacy and security, don't understand AI, and think it will be hard to use AI. It might be challenging to keep up with the rapid pace of technological advancement and successfully use new findings in clinical practice.4

Given these obstacles, there is a strong need for studies that assess dental professionals' knowledge, skills, and perspectives on artificial intelligence.5It is important for academics and educators to have a better understanding of the dental community's existing AI literacy level in order to promote the equitable and appropriate utilisation of AI technology in dentistry. They may use this knowledge to create training courses, educational campaigns, and policy initiatives.

Literature Review

The dentistry sector has greatly benefited from the growth of technology driven by AI. In recent years, the dental industry has heavily supported AI research, especially in the domains of patient management, treatment planning, and diagnostics. The goal of this literature review is to provide a concise overview of where artificial intelligence research in aesthetic dentistry and prosthodontics is at the moment.

There have been a number of studies looking at how artificial intelligence (AI) might improve cosmetic dentistry diagnostics and outcomes. In their narrative overview of AI applications in cosmetic dentistry, Patel and Punwani (2019)6 cite examples such as virtual treatment planning, teeth segmentation, and smile design analysis. Lee et al. (2020)7 explored the issue in depth as they discussed the current state and future prospects of artificial intelligence in dentistry. Using examples like computer-aided smile design and predictive modelling of treatment results, the authors showed how AI may enhance cosmetic outcomes.

Technologies driven by artificial intelligence that streamline the manufacturing of dental prosthesis have recently seen a surge in utilisation within the prosthodontics business. Artificial intelligence (AI) has several potential uses in dental implantology, which Fennis et al. (2021)3 examined in detail. These uses include, but are not limited to, surgical navigation, prosthesis optimisation, and implant placement planning. The authors emphasise that AI has the ability to improve clinical outcomes and patient satisfaction by making implant therapy techniques more predictable and dependable.

Additionally, research on the possibility of artificial intelligence to improve operational efficiency and clinical decision-making in dentistry clinics has been conducted. Al-Fahdawi et al. (2021) found in their narrative review that AI knowledge might one day change healthcare as we know it.1. The authors state that dentists' diagnostic abilities may be enhanced by artificial intelligence (AI), leading to a higher percentage of early disease diagnosis. They spent a lot of time discussing the AI-driven diagnostic tools for dental problems, gum disease, and oral cancer.

There is still a considerable distance to go before AI is widely used and integrated into healthcare systems, regardless of how promising it may seem. The benefits of teledentistry were thoroughly reviewed by Estai et al. (2018)2, who took into account all relevant scientific information. The primary objective of the project was to develop methods to enhance the availability of dental treatment and to enable remote consultations via the use of telehealth technologies enabled by artificial intelligence (AI). There has to be further research evaluating the efficacy and affordability of AI-powered tele-dentistry treatments in different clinical settings, the authors say.

There are several ways in which AI might transform prosthodontics and cosmetic dentistry, as shown in the research review. Enhanced patient outcomes, more precise diagnoses, and more efficient treatment planning are just a few examples. The present problems may be solvable with further research into the incorporation of AI into routine dental practice. Enhancements to clinical judgement, efficiency, and patient care may result from dentists using AI-powered solutions.

Smith et al. (2018) found that 84% of the time Read this comprehensive research to learn about the current state of artificial intelligence (AI) applications in dentistry. The potential applications of artificial intelligence in dentistry were extensively discussed in our paper. These

applications include predictive analytics, treatment planning, and diagnostics.

In 2019, the use of AI in prosthodontic therapies was the subject of a scoping study by Johnson et al. Among them were computer-aided design (CAD) of dental prosthesis, virtual treatment planning, and digital smile design. The findings might lead prosthodontists to believe that AI boosts patient satisfaction and the efficacy of therapy.

Assuming the validity of Lee et al. (2020), then 9. The most recent studies on artificial intelligence (AI) in cosmetic dentistry will be reviewed in this study. In this study, we look at the use of facial recognition software, VR simulations for treatment planning, and AI for smile design analysis. Artificial intelligence (AI) has the potential to improve the aesthetics of dental work, which the authors stress may make patients happier.

Four articles published by Garcia et al. (2019) centre on AI in dental diagnosis. The foundation of our literature review is these investigations. This study aims to use machine learning algorithms to accurately diagnose oral cancer, periodontal disease, and cavities.Based on their research, the authors conclude that machine learning might significantly improve dental diagnostics and early detection.

Martinez et al. (2021) authored it. Section ten Research into artificial intelligence (AI) for oral surgery is the focus of this article. Preoperative planning, intraoperative guidance, and postoperative result prediction are just a few of the many applications of artificial intelligence (AI) that were investigated in this study of oral surgery.When it comes to oral surgery, the authors weigh the pros and cons of using AI.

This article presents a comprehensive evaluation of machine learning approaches in endodontics, drawing on the findings of Patel et al. (2020): 11. Objectives of this effort include procedural improvement, artificial intelligence model development for periapical and pulpal illness detection, and treatment efficacy prediction. Machine learning has the potential to improve endodontic treatment planning and decision-making, according to the authors.

This year, Khan et al. discovered twelve. The purpose of this research is to investigate possible uses of artificial intelligence in periodontics. One component of the research is an AI-powered tool for periodontal risk assessment, disease identification, and treatment planning.The authors highlight the potential benefits of AI in dentistry and the results it may bring to patients.In light of the information provided by Nguyet al. (2021): a dozen To further our knowledge of orthodontics' use of ML techniques, we embarked on an experimental study project.The main goal of this study is to evaluate the accuracy and consistency of machine learning models used in orthodontic treatment planning, the creation of individualised orthodontic appliances, and the prediction of orthodontic outcomes. They claim that orthodontic care and treatment might be drastically altered by the advent of machine learning. In this article, we focus on the findings of Wang et al. (2020) specifically related to artificial intelligence applications in removable prosthodontics. This project will include AI-driven patient care skills like as digital denture design, occlusal analysis, and treatment planning. The use of AI to automate repetitive tasks could have far-reaching consequences for removable prosthodontic treatment.

In their 2019 study, Kim et al. include fifteen This article explores the use of machine learning techniques in the field of implant dentistry. The purpose of this study is to develop AI-driven tools that can forecast implant failure, evaluate bone quality, and plan the placement of implants. The authors discuss some potential applications of machine learning that might enhance dental implant treatments.

Materials and Methods

Particularly targeted at prosthodontists and cosmetic dentists, this cross-sectional research seeks to investigate their views and utilisation of AI within their practice.Members of the general dental community, prosthodontists, and cosmetic dentists make up the study's population.Our data was acquired from 100 dentists using a convenience sample to make sure it was representative.

We created a comprehensive poll to measure the general public's understanding of AI in the dental field. The demographics, education level, AI knowledge, and ideas for AI healthcare applications are all part of the survey questions.
Our electronic survey distribution approach includes reaching out to potential respondents via professional social media, email, and newsletters from relevant groups. Every participant is briefed on the study's aims and given the guarantee that their responses will remain anonymous and confidential. During that time, individuals may go at their own speed as they fill out the survey.

We combine the survey data with the demographic information by using descriptive statistics such as averages, standard deviations, and percentages. We explore potential relationships between various factors and people's knowledge of AI in dentistry using inferential statistics such as chi-square tests and independent t-tests.

Result

The purpose of this cross-sectional research is to look at how prosthodontists and cosmetic dentists see and apply AI in their work. There are three subspecialties of dentists represented in the study's population: general, prosthodontic, and cosmetic. To guarantee that our results were representative of the dental community, we surveyed 100 dentists using a convenience sample.

For this reason, we conducted an extensive study to gauge general awareness of AI in the dental field. The survey inquires about demographics, level of education, level of AI knowledge, and possible AI healthcare applications, among other things.
We plan to reach out to potential respondents using email, professional social media, and relevant organisational newsletters as part of our strategy for electronic survey distribution. Participants are briefed on the study's objectives and given the guarantee that their responses will remain confidential and anonymous. All respondents have that time to go at their own speed when filling out the survey.

We combine the demographic data with the survey outcomes using descriptive statistics such as averages, standard deviations, and percentages. We use inferential statistics such as chi-square tests and independent t-tests to look for connections between various factors and people's knowledge of AI in dentistry.

Table1: Frequency distribution of awareness levels of dental professionals regarding various aspects of artificial intelligence (AI)

		Yes	No
Are you aware of artificial intelligence AI and neural networks NN?		65	35
Are you aware of role of AI in Education and Ethic		39	61
Are you aware of application of AI in Dental specialities ?	(i)Oral Surgery	31	69
	(ii)Endodontics & Conservative dentistry	32	68
	(iii)Periodontics	33	67
	(iv)Orthodontics	34	66
Are you aware of role of AI in Prosthodontic proceedures?		35	65
Are you aware of role of AI in Prosthodontics Procedures?Rpd-fpd/maxillofacial prosthesis/implants/cad-cam		30	70

There is a wealth of information available on artificial intelligence (AI) and its potential applications in the dental field. The subspecialties of conservative dentistry, periodontics, endodontics, and orthodontics had the highest level of awareness, with 31 yes votes and 66 no votes, followed by oral surgery.

Of those who took part, only 35 admitted to being aware of AI's role in prosthodontic treatments, while 65 claimed to be completely unaware. In addition, although 30 individuals claimed to be acquainted with AI, 70 said they were completely unaware of its use in prosthodontic procedures such as RPD-FPD, maxillofacial prosthesis, implants, and CAD-CAM.
The research indicates that different areas of the dentistry industry have different levels of AI understanding, with some showing more awareness than others. Particularly for dentists working in economically depressed areas, more public education and outreach on AI technology might be helpful.

We discovered no statistically significant differences when we examined the groups' levels of knowledge about AI applications in various fields of dentistry using an ANOVA. It would seem that all of the subspecialties within oral surgery, periodontics, orthodontics, endodontics, and conservative dentistry are aligned about the trajectory of AI. The idea that various dental specialties might exhibit vastly diverse degrees of self-awareness was, however, not completely out of the question. Any variations might be explained by random fluctuations rather than true differences, as comprehending the uses of AI is constant across all disciplines of dentistry.

These results highlight the significance of several dentists enrolling in continuing education courses centred on artificial intelligence. To make the most of AI's ability to improve patient care and practice efficiency, we must continue learning about it, even if our awareness doesn't seem to be changing. It is possible that more study is needed to determine what characteristics influence the degree of familiarity with AI's dentistry practice applications.

When asked about their level of understanding of AI in prosthodontic therapy, dental practitioners rated themselves an average of 1.65 (standard deviation: 0.479). An R-value of 0.892 was also found for "awareness of AI in prosthodontics procedures" and "awareness of AI in specific prosthodontic areas," which include RPDs, FPDs, maxillofacial prosthesis, implants, and CAD-CAM technologies, respectively.

Dentists' average understanding of AI's function in four

distinct prosthodontic procedures—RPD-FPD, maxillofacial prosthesis, implants, and CAD-CAM—was 1.7 (SD=0.461).

Based on these results, it seems like most dentists are knowledgeable about using AI to orthodontic treatments. Given the high level of correlation between the two areas of expertise, it stands to reason that prosthodontists who are well-versed in AI in general would also be well-versed in its practical applications (R = 0.892).

The findings highlight the significance of offering comprehensive and ongoing training in prosthodontic AI to dental practitioners. After this, they may easily incorporate it into their practice. This kind of work would be very beneficial for prosthodontic patients and the results of their treatments.

Discussion

The results of the survey show how well dental professionals grasp various aspects of AI and its applications in the dental field. While most people had heard of AI and neural networks, the distribution chart revealed that people's familiarity with the topics varied greatly throughout

Table2: Descriptivestatistic of AI applications across different dental specialties

Groups	Count	Sum	Average	Variance
(i)OralSurgery	100	169	1.69	0.216061
(ii)Endodontic&Conservativedentistry	100	168	1.68	0.219798
(iii)Periodontics	100	167	1.67	0.223333
(iv)Orthodontics	100	166	1.66	0.226667

Table3: ANOVA test conducted on the awareness scores of AI applications across different dental specialties

ANOVA						
SourceofVariation	**SS**	**df**	**MS**	**F**	**P-value**	**Fcrit**
BetweenGroups	0.05	3	0.016667	0.075257	0.973288	2.627441
Within Groups	87.7	396	0.221465			
Total	87.75	399				

Table4: Correlation test on awareness of the role of AI in prosthodontics procedures

	Mean	SD	R
Are you aware of role of AI in Prosthodontics procedures?	1.65	0.479372	0.892143
Are you aware of role of AI in Prosthodontics Procedures? Rpd-fpd/maxillofacial prosthesis/implants/cad-cam	1.7	0.460566	

Currently, there is a lack of information on AI and its possible applications in the domains of ethics, education, and certain subspecialties of dentistry and prosthodontic therapies.

Table 2 offers descriptive information that may be used to better understand the average awareness ratings for different dental specialties. The average levels of AI understanding were quite similar throughout conservative dentistry, periodontics, endodontics, and orthodontics, suggesting that these disciplines had extensive knowledge of the technology.

In Table 3, you can see the outcomes of the analysis of variance test. Dental specialties did not differ considerably in their levels of knowledge of AI's potential uses. These findings suggest that all areas of dentistry are aware of the potential advantages of AI. All healthcare practitioners have a shared understanding of AI's potential medical uses, according to our results, which are in line with earlier studies.16

Understanding the function of AI in prosthodontic operations was also shown to be positively correlated with both overall prosthodontic knowledge and location-specific AI knowledge, according to the correlation test. This shows how multi-disciplinary understanding of AI is crucial in the dentistry industry.

dentistry practitioners and others in the dentistry field would do well to prioritise AI training in light of the results. This endeavour ought to include not only the theoretical underpinnings of AI but also its many practical uses in prosthodontics and dentistry. Better patient care, treatment results, and office efficiency may be the result of dental

professionals acquiring more knowledge and skills in artificial intelligence.

This study looked at the level of understanding of artificial intelligence among dental practitioners, with a focus on prosthodontics and cosmetic dentistry. While poll takers' acquaintance with AI and neural networks varied greatly, the vast majority were aware of the terms. There was a dearth of discussion on the impact of AI on ethics and education, and even less on its role in prosthodontic therapies and other areas of dentistry.

Oral surgeons, endodontists, periodontists, and orthodontics all had similar levels of understanding of AI applications; there were only small differences in the average awareness ratings across the several dental specialties. When looking at the quantity of knowledge regarding AI applications across different sectors, the analysis of variance (ANOVA) results show that there is no significant difference.

Various components of artificial intelligence in dentistry are interdependent; the correlation test showed that general awareness of AI in prosthodontic procedures was positively correlated with general knowledge of AI in prosthodontics. These findings emphasise the need of initiatives to teach and educate dentists so that they may become better AI users. Better patient care, more effective treatments, and more efficient practices might result from funding dental and prosthodontic education in AI.

The rising demand from oral health care professionals who need to keep up-to-date with the latest discoveries in AI and how it applies to dentistry might be satisfied by dental schools and continuing professional development (CPD) programmes that provide AI courses.

1. Source of Funding

None.

2. Conflict of Interest

Conclusion

None.

References

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4. According to Garcia, Patels, and Nguyen's literature review, machine learning may be used to diagnose dental problems."J Dent" (87:1-6) was published in 2019.

5. Helping out Garcia, Johnson, and Williams Artificial Intelligence in Dental Prosthodontics: A Comprehensive Review.Article specifics for the Journal of Prosthodontology publication are as follows: PubMed: 28(4):371-8.

6. Patela and Punwani's 2019 narrative review, "The Role of Artificial Intelligence in Dentistry" (J Dent Allied Sci. 2019;8(2):63-7) was published in the dentistry professional journal.