

Artificial Intelligence in Dentistry

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Aim: This study aims to explore the awareness and application of artificial intelligence [AI] among Dental Graduates and Post-graduates focusing on its potential to enhance awareness, diagnostic accuracy, treatment planning and patient outcome.

Study Design: The research follows a cross sectional survey designed to collect data directly from graduates and postgraduates via google form.

Place of Study: An E-Questionnaire was circulated amongst various Dental colleges of central India.

Methodology: An structured E-Questionnaire was circulated among graduates and post graduates. Responses were collected and analysed using statistical methods to identify trends, knowledge gap and attitude towards AI into dental education. Survey focused on participant’s knowledge, attitude and perceptions regarding AI application in dentistry.

Result: The study included 511 participants (166 Post Graduates and 345 Graduates). This distribution reflected significantly positive results for the

postgraduate despite comprising a smaller portion of the participant pool, they demonstrate Positive response about the survey due to their greater knowledge regarding AI compared to the graduate. Despite having comparatively lesser exposure to AI more than 50% of graduate responded positively to the survey reflecting their optimistic Outlook towards the AI in dentistry.

Conclusion: The survey highlights a growing awareness and positive perception of AI recognizing it’s potential and revolutionize diagnostic and therapeutic practice in dentistry. However significant gaps in practical knowledge and hands on exposure to AI technology underscores the need for integrating AI focus modules into dental curriculum and providing training opportunities to give future dentist dental professionals with the skills required for effectively implementing AI in clinical setup. Clinician shall be chief complaint oriented in his diagnostic approach but AI has the potential of highlighting all the possible findings just by digital scanning of the Oral Cavity and radio-graphs.

Keywords: Survey, Caries, Digital scanning, Chief Complaint, Revolutionize, Oral Cavity, Clinician.

Introduction

Alan Turing first introduced AI in 1950 and named it "Turing test"^{1,2}. Artificial intelligence (AI) is the ability of a machine to perform task that normally require human intelligence³. In the year 1956, AI was coined in the academic field by John McCarthy⁴. AI encompasses various sub-field including Machine Learning (ML), Natural Language Processing, Computer Vision, Robotics⁴. India's first experience with AI was in the 1960s when professor H.N. Mahabala conducted a program on the subject. After 1960 AI has been evolving at very fast pace in India and is now a leader in AI research Publication and as a thriving setup ecosystem involving general, mechanical, IT and medical section.

Artificial intelligence in Healthcare is the application to copy or exceed human cognition in the analysis perception and understanding of complex Medical and Healthcare^{6,7,8}. In dentistry AI has potential to enhance practice efficient. AI works on a data which is collected by the dentists and AI data driven approach make it more helpful in decision making which is appreciated by dental community^{9,10}. In dentistry, AI technology has emerged as a powerful tool, revolutionizing various aspect of oral health care. It involves the use of algorithms and ML to analyze large volume of data⁴. When applied to the field of dentistry artificial intelligence is becoming a boon to dentistry and expanding to play a crucial role in improving accuracy in diagnosis, early detection of carries ,patient education, identification of normal and abnormal structure and many more.

Hence, we have conducted a survey regarding the Awareness of artificial intelligence among the graduates and post graduates in dentistry in Central India.

Methodology

Study Design - Descriptive cross-sectional study.

Study Population - Graduates and post graduates of various dental institution across central India.

Sampling Criteria - Purposive sampling.

Study Instrument - A validated E- Questionnaire was circulated to graduates and post graduates of various dental institutions across central India via E-mails and various social media. The questionnaire was comprised of 10 question.

Statistical Analysis - The data was collected and transferred onto the google form. The descriptive statistics were done to estimate frequency and percentage for responses of the participants.

Result

We circulated a close ended survey via google form which includes 10 questionnaires to assess the awareness of AI among graduates and post graduates in dental field.

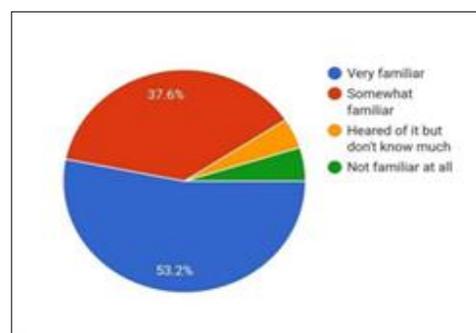


Figure 1: Pie chart representing the familiarity of term AI

53.2% of the participant were very much familiar with the term AI and 37.6% of the participant are somewhat

familiar with AI, which gave us the positive result regarding the awareness of AI (fig.1).

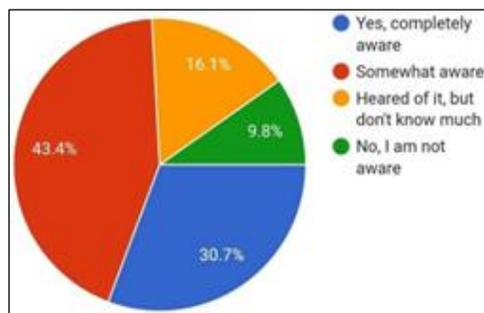


Figure 2: Pie chart represents the awareness of AI in dentistry

The 43.4% response rate was excellent and shows that people are quite aware about AI applications in dentistry, negligible percentage of participants were not aware of any AI application in dentistry (fig.2).

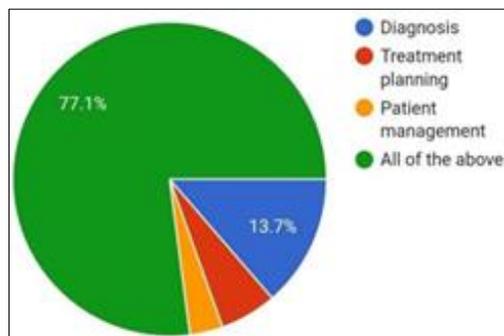


Figure 3: Pie chart shows use of AI in dentistry.

According to the response 77.1% participant share their view as a positive side of AI involving its use in diagnosis, treatment planning and patient management (fig.3).

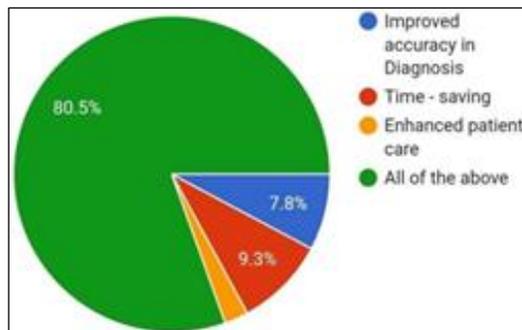


Figure 4: Pie chart represents benefits of AI in dentistry.

Reliability refers to the consistency of the assessment. 80.5% showing potential benefits of AI in improving accuracy in diagnosis, time saving and enhance patient care in dental field (fig.4).

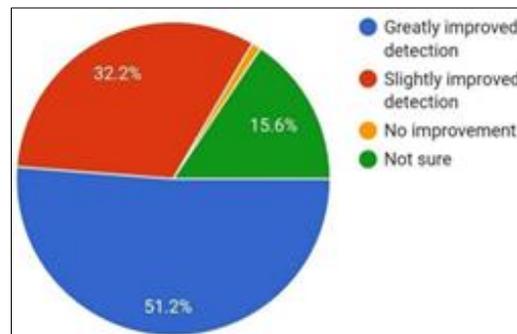


Figure 5: Pie chart shows opinion regarding detection of early oral health issues.

51.2% of the participant gave a generative response of AI being used in dentistry for greatly improved detection of caries, gum disease, oral cancer etc (fig.5).

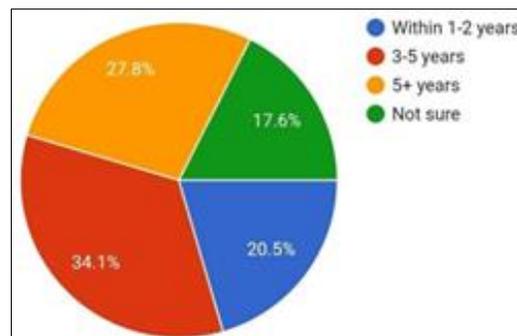


Figure 6: Pie chart shows assumption of AI incorporation in dentistry.

It is a big accomplishment that soon AI will operate and become a master stroke in 3-5 years in dentistry. According to the awareness among people in dentistry application of AI is meant to be obvious but it is not always, which is why hardly a small number of percentage are in dilemma of AI not becoming a perk in dentistry (fig.6).

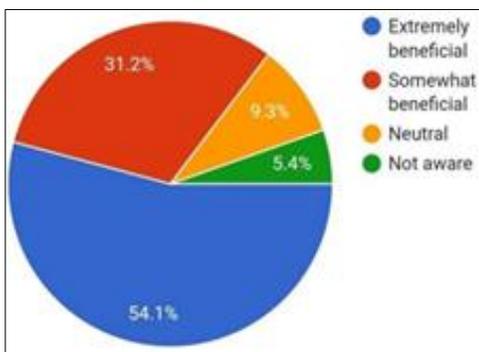


Figure 7: Pie chart shows inclusion of AI based learning in BDS curriculum.

The result is shows 54.1% of the participants considered that AI will minimize human error by providing comprehensive feedback and improving treatment outcome and patient care (fig.7).

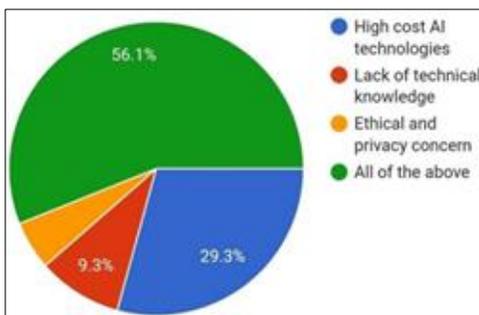


Figure 8: Pie chart represents challenges of implementing AI in dentistry.

Although the future of AI in dentistry is promising but the biggest challenge facing AI is ensuring data privacy and security. Also AI technology is not cost efficient and required technical understanding to get an insight into AI application (fig.8).

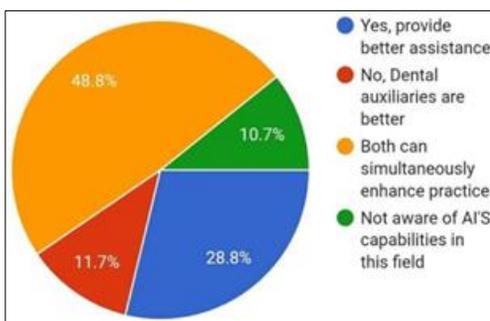


Figure 9: Pie chart Compare effectiveness of AI and dental auxiliaries in providing assistance in dentistry.

48.8% of the participant estimated that combining human knowledge with AI skills has the potential to completely change the dental care and simultaneously enhance the practice (fig.9).

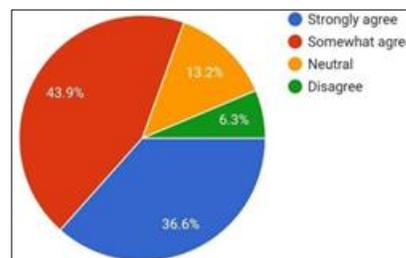


Figure 10: Pie chart shows potential of AI in overcoming dental negligence in diagnosis.

Negligence law is often asked to adapt to new technology and so is with AI but by facing all the challenges AI has the potential to revolutionize dentistry by improving diagnosis treatment planning etc. These AI systems can automatically detect issues like caries, fractures and tumors allowing dentist to make more the precise diagnosis.

Clinician shall be chief complaint oriented in his diagnostic approach. This may lead to overseeing of other major or minor findings. Here AI gives us an advantage of highlighting all the possible findings just by digital scanning (fig.10).

Discussion

The present survey was done in order to assess the awareness of AI in dentistry which gave us a promising result in our present study majority of the participant (>50%) are aware of the AI application in dentistry. AI is increasingly prevalent in both the field of dentistry and the broader global population. AI cannot replace the human intelligence and emotions but it helps the dental professionals by providing multiple possibilities for particular concern¹¹. The majority of the survey participants emphasized the importance of exercising the caution when integrating AI into dentistry, citing

concern regarding ethical implication and the protection of individual privacy¹². A significant portion of participant believed that AI had potential to alleviate workload in dentistry by enhancing the accuracy of diagnosis, treatment planning and patient management.

When we compared our data with JELENA ROGANOVIC. ET. AL STUDY¹⁵ of AI in dentistry, we got the following result concluded in the Table 1.

Table 1:

Sn.	Point of Comparison	Our Study	Study By Jelena Roganovic ET AL.
1.	Awareness of AI Application in Dentistry	Familiar - 43.4 % Not Familiar - 9.8 %	Partly - 58.3 % Not Awareness - 27.1 %
2.	AI Assistance Level Compared To Dentist	Both - 48.8 % No - 22.2 %	Partly Replace - 32.3 % No - 64.1 %
3.	AI Application in Dental Curriculum	Yes - 54.1 % No - 5.4 %	Yes - 45.8 % No - 14.1 %
4.	AI Efficacy and Benefits in Dentistry	Overall Beneficial - 80.5 % individually beneficial - 19.5 %	Yes - 57.3 % Partly Effective - 36.5 %

Description of the Contents

After analysis of awareness of AI application in dentistry and comparing it with similar studies conducted by other authors we concluded that:-

1. Awareness of AI application is more than 40% among the respondents in our study whereas 50% respondents were aware in the study conducted by jelena roganovic et al.
2. More than 45% respondents in our study have firm conviction that AI and dental auxillaries will enhance practice whereas 32% respondents in the comparative study believe that ai will partially replace dental auxillaries.
3. 54% of the respondents are in favour of incorporating AI into dental curriculum while 5.4% oppose, whereas in the comparative study 45% supported the inclusion of ai and 14% opposed.
4. 80.5% of the respondents firmly believe that ai overall enhance the efficacy whereas 57%

respondants were sure of its efficacy and benefits in the comparative study.

We observed that the other study from which we compared our result was published in 2023 in russia which clearly depicts the awareness and acceptance is significantly improved with a year among students and clinicians. It will further show growth impressively within less than a decade in various developed as well as developing countries.

Conclusion

Our survey clearly depicts AI has progressed remarkably in dentistry. There is considerable level of awareness about AI among graduates and postgraduates. AI Technology such as machine learning (ML) and image recognition enable more accurate and efficient detection of oral health issues like caries, gum disease and oral cancer etc, and enhancing diagnostic capabilities. AI can assist in personalized treatment plan by analyzing patient data and predicting outcomes

leading to more precise interventions. AI continued advancement promises to play a crucial role in shaping the future of dentistry, offering enhanced accuracy, efficiency and patient satisfaction. AI in dentistry offers numerous benefits but also has some drawbacks i.e. high implementation costs, data privacy concern and dependence on accurate data poses significant challenges.

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