

THE USE OF ARTIFICIAL INTELLIGENCE IN DENTAL PRACTICE AND PATIENTS' ATTITUDES TOWARDS IT

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Abstract: Artificial intelligence is a broad field that encompasses various techniques and methods aimed at creating intelligent machines capable of performing tasks that typically require human intelligence. AI has definitely been rapidly expanding into the healthcare sector to improve medical care by analysing large amounts of data and providing insights that can aid in diagnosis and treatment decisions and incorporating digital intelligence into medical equipment and instruments can enhance procedures and improve patient outcomes. In conclusion, AI is rapidly advancing in the field of dentistry, offering numerous benefits, but it also brings ethical, privacy, and fairness considerations.

The study aims to identify the knowledge and attitude of the patients towards use of AI for diagnostics and treatment in dental practices.

Material and methods: The study involved 165 patients with an average age of 39.27 years, ranging from 18 to 60 years. A survey was conducted among patients who visited the clinic for a period of 2 months. The survey is anonymous, but the people who participated in it had to be over 18 years of age. The participants received a written instruction from the survey itself that it was necessary to indicate only one answer to each question.

Results: Out of the entire contingent of patients, 114 (69.10%) trust the doctor for an accurate diagnosis, and only 21 (12.72%) rely on an accurate diagnosis made by artificial intelligence (AI), almost 1/5 of the patients (30 people – 18.18%) cannot yet assess where their preferences and trust are leaning. For performing the treatment activities, themselves, more than half of the patients vote trust in the real medical activity - 106 people (64.24%) and only 24 people, which is 14.54%, would trust dental treatment performed by a machine controlled by a computer. Again, more than 1/5 of the respondents cannot decide (35 people – 21.22%), perhaps due to a lack of knowledge and idea about the type of treatment procedures managed by artificial intelligence.

Conclusion: The present study assessed the attitude of Bulgarian patients towards use of AI in diagnostics and treatment. The results show that in the traditionally manual profession as dentistry, patients rely in a large percentage (64.24%) on the dental work done by humans. The same applies to making a diagnosis by a doctor - 69.10% trust the doctor's competence and knowledge when making the diagnosis. Still a small percentage of Bulgarian patients believe in AI.

Keywords: Artificial intelligence, Dental practices, Digital transformation, Patient perception

1. INTRODUCTION

Artificial intelligence is a broad field that encompasses various techniques and methods aimed at creating intelligent machines capable of performing tasks that typically require human intelligence. These tasks include visual perception, speech recognition, decision making, and natural language processing (Vodanović et al., 2023). Machine learning and deep learning are two branches of artificial intelligence that play a significant role in enabling machines to learn from data and make predictions or decisions based on that learning. Machine learning focuses on algorithms and statistical models that allow machines to learn patterns and make predictions, while deep learning involves training artificial neural networks with large amounts of data to perform complex tasks (Avanzo et al., 2021)(Lecun et al., 2015)(Amjad et al., 2023).

AI has definitely been rapidly expanding into the healthcare industry and has the potential to be used in several ways. Firstly, AI can be utilized to improve medical care by analysing large amounts of data and providing insights that can aid in diagnosis and treatment decisions. Secondly, incorporating digital intelligence into medical equipment and instruments can enhance procedures and improve patient outcomes. Thirdly, AI can be used to assess patient records and identify factors that may contribute to errors, helping to improve patient safety. Lastly, AI can propose new treatments based on existing ones, potentially leading to advancements in medical research and innovation (Amjad et al., 2023)(Pacis et al., 2018).

The integration of artificial intelligence (AI) into the field of dentistry is indeed transforming various aspects of dental care and dentistry as a whole. This technological advancement offers both advantages and potential challenges (Vodanović et al., 2023).

AI can process and analyse large volumes of dental data quickly and accurately, aiding in diagnosis and treatment planning. It can assist in tailoring treatment plans to individual patients' needs, taking into account their unique dental conditions and medical history (Hung et al., 2023)(Hegde et al., 2022)(Adeoye et al., 2021). AI can predict the likelihood of dental problems based on patient data, facilitating early intervention and prevention. Automation of tasks through AI can reduce the need for manual labour and lower overall costs in dental practices (Reyes et al., 2022)(Huq et al., 2022)(Schwendicke & Krois, 2022)(Schwendicke et al., 2021)π

However, there are some disadvantages to it. AI systems can inherit biases from the data used to train them, potentially leading to disparities in diagnosis and treatment recommendations. Understanding how AI algorithms make decisions can be challenging, and accountability for errors may be unclear. The use of electronic dental records and patient data in AI systems may raise privacy and security issues, necessitating robust data protection measures. Ethical considerations related to patient autonomy, responsibility, and decision-making may arise when AI systems are involved in dental care. While not a significant concern currently, some tasks and procedures may eventually be replaced by AI, affecting the roles of dental professionals (Shetty et al., 2018)(Nayyar et al., 2020).

To address these challenges, it is essential to develop and enforce regulations that ensure the safety, effectiveness, and ethical use of AI in dentistry. This includes addressing bias, data privacy, and transparency. AI systems in dentistry should be continually improved and developed to address shortcomings and adapt to changing needs. Dental professionals should be adequately trained in using AI tools and understanding their limitations. Efforts should be made to ensure that AI systems are accessible and affordable to all patients and communities, mitigating disparities in access to healthcare (Lecun et al., 2015)(Avanzo et al., 2021).

In conclusion, AI is rapidly advancing in the field of dentistry, offering numerous benefits, but it also brings ethical, privacy, and fairness considerations. Careful implementation, regulation, and ethical considerations are necessary to maximize the advantages of AI in dentistry while mitigating potential challenges and disparities (Geis et al., 2019).

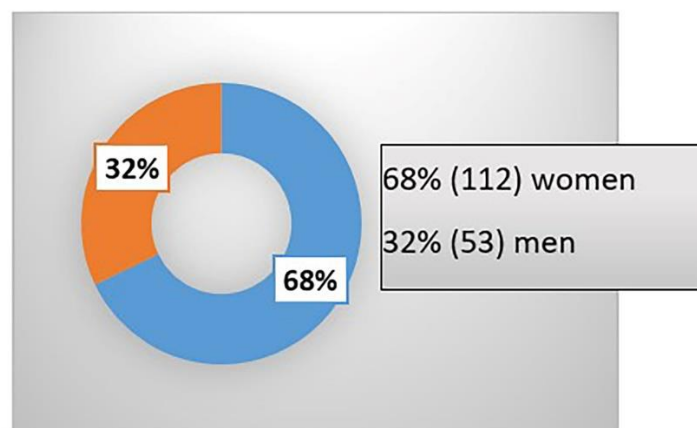
Patient attitudes toward AI in dentistry can vary widely, and they are influenced by several factors, including individual preferences, trust in technology, and experiences with AI applications in healthcare.

The study **aims** to identify the knowledge and attitude of the patients towards use of AI for diagnostic and treatment on dental practices.

2. MATERIAL AND METHODS

Material: The study involved 165 patients with an average age of 39.27 years, ranging from 18 to 60 years. The gender distribution of the participants is: 53 (32.12%) males and 112 (67.88%) females (Fig. 1). The average age of males is 41.15 years, and for females, it is 38.39 years.

Fig. 1: Gender distribution of participants



Methods

Prior to formulating a survey, it is imperative that we possess a comprehensive grasp of our research goals and the precise data we aim to gather. Subsequently, we undertake a thorough examination of existing surveys or validated tools through a literature review, aligning them with our research objectives. It came to our attention that there was a lack of a sufficiently refined questionnaire tailored to our requirements, prompting us to develop and pilot-test a questionnaire. The questionnaire consists of 8 questions, multiple - choice with one possible answer. A survey was conducted among patients who visited the clinic for a period of 2 months. The survey is anonymous, but the people

who participated in it had to be over 18 years of age. The participants received a written instruction from the survey itself that it was necessary to indicate only one answer to each question.

3. RESULTS

Out of the entire contingent of patients, 114 (69.10%) trust the doctor for an accurate diagnosis, and only 21 (12.72%) rely on an accurate diagnosis made by artificial intelligence (AI), almost 1/5 of the patients (30 people – 18.18%) cannot yet assess where their preferences and trust are leaning (Fig. 2).

Fig.2. Results from the questionnaire according to opinion of patients towards Diagnosis.

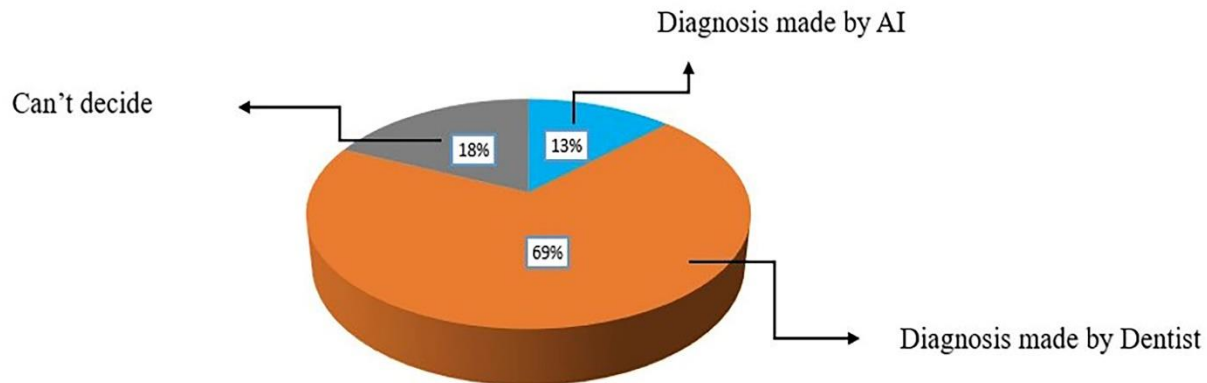
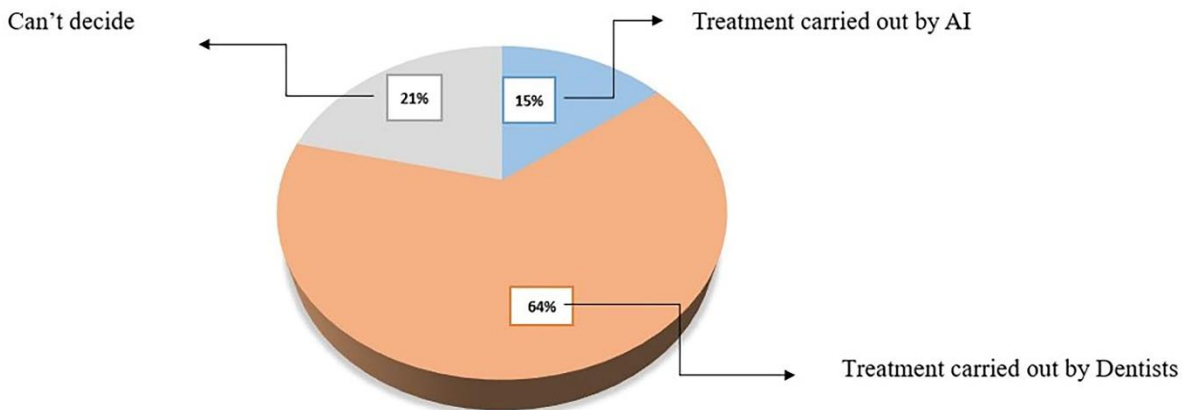


Fig.3. Results from the questionnaire according to opinion of patients towards Treatment.



For performing the treatment activities, themselves, more than half of the patients vote trust in the real medical activity - 106 people (64.24%) and only 24 people, which is 14.54%, would trust dental treatment performed by a machine controlled by a computer (Fig. 3). Again, more than 1/5 of the respondents cannot decide (35 people – 21.22%), perhaps due to a lack of knowledge and idea about the type of treatment procedures managed by artificial intelligence.

3. DISCUSSION

The present study assessed the attitude of Bulgarian patients towards use of AI in diagnostics and treatment. The results show that in the traditionally manual profession as dentistry, patients rely in a large percentage (64.24%) on the dental work done by humans. The same applies to making a diagnosis by a doctor - 69.10% trust the doctor's competence and knowledge when making the diagnosis. As one can see the small percentage of Bulgarian patients that believe in AI controversy to the study of Kosan and co in which they conclude that the trust in a dentist's

decision was high in both conventional communication and AI-based communication (Kosan et al., 2022). In research made by Muller et al was found that both – dentists and patients, were positive and opened towards AI for dental diagnostics, noting the chances for a higher diagnostics quality, a relieved daily workload and a better communication and decision-making (Müller et al., 2021). The percentage of patients who rely on medical diagnosis and treatment made by the dentist almost overlap. Probably the differences between the results in previous mentioned studies and ours is the percentage of group of patients who cannot judge and do not express their opinion on the discussed issues. Perhaps their hesitancy stems from their lack of information on the matter or their lack of experience in dental treatment. In a study by Yordanova (Yordanova & Gurgurova, 2021) on the patient attitude towards intraoral scanning versus taking conventional impressions of the jaws, it was reported that if the patients have the chance to choose only one of these procedures, they will prefer intraoral scanning in 73.58% of the cases. For 94.33% of the interviewed patients the intraoral scanning (which is a new digital manipulation) was of great interest and only few patients perceive it as clinical manipulation. Therefore, when people have the opportunity to try and compare, they already have a new attitude towards the proposed changes. It is necessary to state that the communication skills of the medical team in a dental practice is a key for its development and digitization (Грера Йорданова, 2021). This directs researchers to focus their efforts on new marketing strategies, filled with content in accessible language and with sufficiently easy-to-understand examples. It should not be overlooked that standards in dentistry are governed by the principle of evidence-based medicine. Therefore, any introduction of a new and innovative product that enters the dental field must comply with this principle. The study actually gives an indication that we should aim for a change of activity that is a response to consumer (patient) demand and expectation. Digital transformation will streamline many dental operations, it will be efficient and will lead to team development and satisfaction, but patients must be prepared for it (Yordanova et al., n.d.). In the opposite direction, the medical team receives greater competitiveness of new products (treatments) and the possibility of constant monitoring of the effectiveness of the performed treatments. For every business, it is true that successful marketing management is based on the analysis of data from previous performance, planning, organizing and implementing future marketing activities and marketing control.

4. CONCLUSIONS

In Bulgaria, still the patients believe more in dentists and their knowledge, opinion and experience for making diagnosis, treatment plan and treatment. The future is in our hands to change their attitude to become positive towards computer and technology. Digitalization should gradually enter clinical dental practice. The change will affect every stage of patient care. Thus, the patient will perceive the changes step by step and will be able to actively participate in them.

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