



ARTIFICIAL INTELLIGENCE AND ITS STARRING ROLE IN DENTISTRY: A PERSPECTIVE QUESTIONNAIRE STUDY WITH REVIEW OF LITERATURE.

Dental Science

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ABSTRACT

As there is increased preponderance and prevalence of varied diseases affecting huge population including dental diseases like severe infections secondary to pulpal and periodontal pathologies, Maxillary pathologies, Oral cancer, Osteoporosis, esthetical issues like Malocclusion, etc. which in turn should be given special care when it comes to geriatric patients and people suffering with various comorbidities where sometimes it demands for advanced technologies especially in terms of multidisciplinary approach, Artificial intelligence has become a boon to dentistry making their work more simpler and accurate. This article is one of its own kind of rare questionnaire study which focus on knowing knowledge, awareness and perception of dentists of northern telangana population regarding Artificial intelligence.

KEYWORDS

Artificial intelligence, human brain, healthcare, dentistry, 3D printing, Robotics.

Introduction:

In 21st century Artificial intelligence has brought a great revolution in the field of medicine and dentistry with the greater advancements that occurred in the field of science and technology¹. Its peculiar features such as increased quality and efficiency has made us to apply it in almost every field such as games, car driving, performing cognitive tasks, medical analysis such as MRI, analysis for brain tumour, financial analysis, security analysis, robotics, engineering, etc.,^{2,3} Similarly with the increased demands in the field of dentistry for a more sensitive and specific aids for making accurate diagnosis avoiding wastage of time, appropriate treatment thereafter and for making better patient satisfaction has made us to use and opt this AI as a current trend to be used in dentistry.¹ Thus, the aim of our study is to identify the knowledge, attitude and perception of Artificial intelligence among the various dentists in north telangana population based on a questionnaire study.

Materials and Methods:

In this study 10 multiple choice questions were framed using Survey monkey analysis and circulated among the dentists through online network media like whats up and face book messenger and 24 responses were collected finally which includes Undergraduate students, Postgraduate students, Practitioners and Academicians of northern telangana. (Illustrated in graphs 1 to 10).

Results:

The data was collected and then subjected to statistical analysis using the same online platform i.e. survey monkey analysis which were then interpreted thereafter. It revealed that around 62% of study group are aware of AI and its use in field of dentistry (Graph 1). Similarly around 75% of study population agree that AI is based on mechanism of human brain (Graph 2) and 66.67% opined that its usage contributes to reduce morbidity and mortality in Oral and maxillofacial diseases and in terms of patient care (Graph 3).

There after 66.67% of the study population agrees that AI can be used in various fields such as Diagnosis and treatment planning, Digital radiography, etc. (Graph 4). And 62.50% of the dentists agree that AI not only saves time but also improves accuracy in diagnosis and standardization of procedures (Graph 5). But 62.50% of dentists are also of opinion that AI carries disadvantages such as lack of emotional touch, rate of faulty data obtained along with its complexity in

mechanism and the cost involved (Graph 6).

Among this 79.17% of study population were of the opinion that AI has its greater rushing and integration in upcoming fields like Implant dentistry, Reconstructive dentistry, Oral cancer screening, diagnosis and treatment (Graph 7). Similarly 83.3% of dentists showed interest in using AI when needed (Graph 8) and 79.17% wants recommend it to fellow dentists (Graph 9). Then 45.83% of study population views that AI can only be an aid to field of dentistry and dental education but nowhere replaces the role of dentist, the human knowledge, skill and the decision making ability (Graph 10).

Discussion:

History and the birth of AI:

This era of 21st century has left many unreadable footprints of AI in the various fields of medical and health sciences with the greater advancements and revolutionary changes occurring in the fields of science and technology every day. However, the petty cash coins for AI were laid down from the era of 4th century dated back to those of Aristotle's who early attempted to formulate the association between logic and thinking through his syllogisms (a three part deductive reasoning) thereafter many tremendous inventions has been occurred in the field of the computers, health, science and technology⁴.

The field of artificial intelligence research was founded as an academic discipline in 1956.⁵ Artificial intelligence has close connections with philosophy because both use concepts that have the same names and these include intelligence, action, consciousness, epistemology and even free will. Furthermore, the technology is concerned with the creation of artificial animals or artificial people so the discipline is of considerable interest to philosophers. These factors contributed to the emergence of the philosophy of artificial intelligence. Some scholars argue that the AI community's dismissal of philosophy is detrimental.⁶

Turing's test: In 1950 Alan Turing published a landmark paper in which he speculated about the possibility of creating machines that think. He noted that "thinking" is difficult to define and devised his famous Turing Test. If a machine could carry on a conversation such as over a teleprompter that was indistinguishable from a conversation with a human being, then it was reasonable to say that the machine was "thinking". This simplified version of the problem allowed Turing to argue convincingly that a "thinking machine" was at least plausible and the paper answered all the most common objections to the

proposition. The Turing Test was the first serious proposal in the philosophy of artificial intelligence.⁷

The term "Artificial Intelligence" was coined by a mathematician John McCarthy in 1955 and he was also recognized as the "Father of artificial intelligence" due to the tremendous contributions made by him to the field of Artificial intelligence.⁸ In the year 1956, John McCarthy organized a famous Dartmouth conference with a theme of research project on artificial intelligence, this is how this discipline has gained its importance and sparked a greater revolution in the field from 1950s to 1970s.⁹ Thereafter in 1978 Richard Bellman, a well-known mathematician defined artificial intelligence as the automation of activities associated with human thinking abilities, which includes learning, decision making and problem solving.¹⁰

Mechanism or Principal involved:

AI works on the principal of Machine learning and deep learning which often requires a basic knowledge on computers and their operation. Here, Algorithms forms a key factor for proper functioning of AI which are nothing but a specific solution or procedure created or built within a digital gadget using specific data intended to be used for a specific purpose.

E.g. Google assistant app in mobiles, apex locator intended to be used in endodontics, digital radiography, etc. Thus, many algorithms together forms an artificial neural network which many of them again together forms an artificial brain and thus working perfectly as an Artificial intelligence mimicking human brain.^(11,12) (Fig 1, 2)

AI and Healthcare system in India:

Many of the studies in the recent years has explored that deep learning algorithms helps us in giving better insights to predict the prognosis and future events in patients. It helps clinicians in prevention as well as early detection of diseases by capturing and analysing various vitals of patients and also helps in making it possible to access the learning and data from hundreds of thousands of patient cases. Apart from these Artificial intelligence (AI) and machine learning (ML) are witnessing increasing adoption in the Indian healthcare setting. With a surge in non-communicable diseases and the increasing number of aging population in the country, the overall burden of disease management has been increasing year-on-year and to manage that, the government, the healthcare professionals and the healthcare institutions are looking for innovative ways.¹³

Applications of artificial intelligence in health care¹⁴:

1. Drug development
2. Disease diagnostics
3. Analysis of health plans
4. Health monitoring
5. Digital consultation
6. Surgical treatment
7. Monitoring medical data
8. Personalized treatment
9. Managing medical data

AI In dentistry:

AI has been used mainly in dentistry to make the process of diagnosis more accurate and efficient, which is of utmost importance in achieving the best results to the treatments provided along with superior quality patient care. Dentists need to use all their acquired knowledge to diagnose and decide the best treatment option. They are also required to predict the prognosis where they need accurate clinical decision-making skills. However, in some cases, dentists do not have enough knowledge to make the right clinical decision in a limited period. AI applications can serve as their guide so that they can make better decisions and perform better.¹⁵

Applications of AI in dentistry^{12,15}:

1. **General dentistry:** Diagnosis and treatment planning, scheduling appointment and clinical decision making.
2. **Oral Medicine and Radiology:** Screening and diagnosing oral mucosal lesions, oral cancer, Osteoporosis, Maxillary sinus pathologies, RVG, Digital OPG, Cephalometry, CBCT, MRI, etc.
3. **Oral-maxillofacial surgery:** Assessing typical extractions, association between 3rd molar and inferior alveolar canal, 3D printing for surgical template preparation, prediction softwares for analysis of surgical outcome during treatment planning of orthognathic cases.
4. **Conservative dentistry and endodontics:** Detection of caries, WL

determination, locating Apical foramen, endodontic surgeries, etc.

5. Periodontics: Assessing severity of bone loss, peri-implantitis, etc.

6. Orthodontics: Diagnosis and treatment planning using digital impressions, 3D scans, virtual models, AI conjugated aligners, etc.

7. Prosthodontics: Calculating anthropological data, facial measurements, esthetics; preparing inlays, onlays, crown and bridges, CAD CAM technology, VRS, etc.

8. Forensic odontology: Assessing age estimation using radiographs, bite-mark analysis, etc.

9. Implant dentistry: Virtual treatment planning with implant planning software to plan implant placements.

Advantages:

1. Needs a fraction of time in performing tasks when compared to regular procedures.
2. Helps in increasing the accuracy of diagnosis by the way of logical and feasible decisions.
3. Helps in improving the standardization of the procedures.

Disadvantages¹⁵:

1. Complexity of mechanism involved
2. Expensive
3. Needs adequate training
4. Needs human touch

Till now there are only few studies in the literature that are carried out to know and assess the knowledge and perception of dentists regarding Artificial intelligence. In the year 2017 Raksha Maskara et al¹⁶ has done a similar study in the population of Gujarat and concluded that most of the dentists are well aware of AI and its interventions in their field and some of them are already using it. Though, never the less the dentists are in agreement with the relevance and advantages of AI and they also perceive high cost and lack of human touch as disadvantages. However, AI with the profound transformations occurring in the field will be definitely going to benefit the society for decades which was also concluded from our study.

In the year 2020 Sanjeev.B et al in their systematic review has concluded that this automated systems are of greater value in screening osteoporosis, oral cancer and the metastasis of lymph nodes and its contribution is priceless as it helps the professionals in screening at early stages thus saving human lives. However, even though it is used in various fields of dentistry some specialties such as pedodontics and oral pathology still lack the development and application of the AI technology.¹⁷ Apart from this both the authors were of the opinion that AI has 3D printing and Robotics as its upcoming areas in the future hereafter and thus our study is a one of its own kind of questionnaire study whose observation concludes with the above studies.

Conclusion:

AI is definitely a boon to dentistry, which simplified everything including diagnosis, treatment planning, disease monitoring, data storage, data transport, helping in not missing minute details of the pathology, etc. however in developing countries like India it is still taking tiny steps where both the government and private sectors should play a crucial role encouraging young scientists for building up more devices and technologies which works on AI for a better tomorrow.

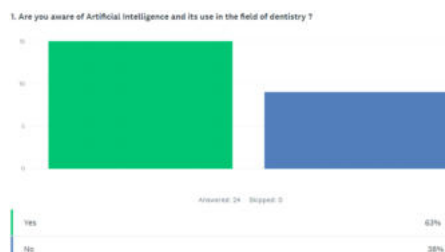


Figure 1

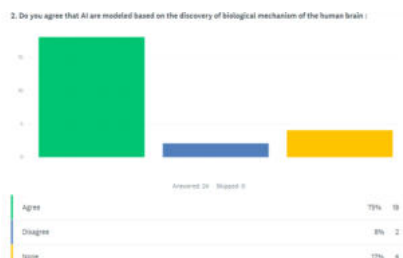


Figure 2

Graph 1



Graph 2



Graph 3



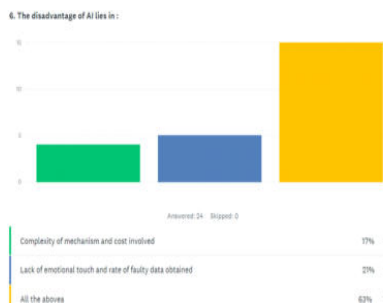
Graph 4



Graph 5



Graph 6



Graph 7



Graph 8



Graph 9



Graph 10



Graph 11: Quiz summary



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