

Longitudinal Analysis of Artificial Intelligence Awareness amongst Dentists in India: A Cross-Sectional Study

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Abstract

The implication of Artificial Intelligence in our day to day life is gigantic. Even through heaps of research and advancements there is always a hitch on whether Artificial Intelligence can be used in the field of medicine and dentistry as we deal with human lives. **Aim and Objectives:** This survey was developed to begin evaluating the perception of Artificial Intelligence amongst dentists in India. Also, to gauge the concerns and opinions on the emerging use of Artificial Intelligence in dentistry, dental research, and training of the dental students. To our knowledge, no such cross-sectional study on the role of Artificial Intelligence in dentistry has been done in India. This survey is first of its kind being published to evaluate the awareness of Artificial Intelligence amongst practitioners. **Methodology:** A set of close ended questions were randomly distributed to 104 dentists in India, 50 graduates and 54 postgraduates. The knowledge they had of Artificial Intelligence was assessed by google forms, assembled and scrutinized statistically to assess any correlation amongst the variables. **Result:** The mean age of 28.73±5.72 years was observed with no significant difference seen age wise and gender wise. Overall, around 67% of the respondents were aware about the concept, advantages and disadvantages of Artificial intelligence in healthcare. The mean score of postgraduate study participants was significantly higher than undergraduate study participants with a p value of 0.04. **Conclusion:** Understanding the various concepts of Artificial Intelligence and the techniques involved will give us a lead in the coming when we will have to adapt to the newer techniques being incorporated in our day to day clinical practice. To conclude, I would like to say that there could be both positives and negatives of Artificial Intelligence, it all depends on how we incorporate it into the system. Also, a larger group of dentists should be surveyed and evaluated for better knowledge and understanding.

Keywords: Artificial Intelligence, Cognitive Skills, Artificial Neural Network, Deep Learning, Dentists, Survey

INTRODUCTION

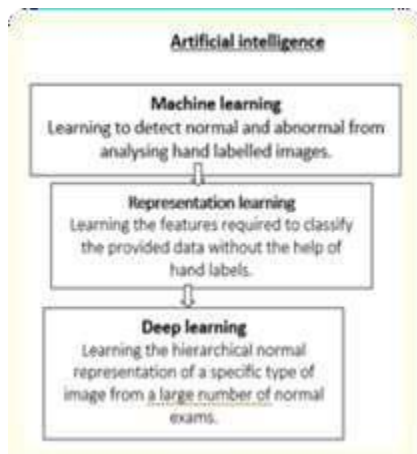
Homo sapiens is a Latin term for “wise man” which was introduced by Carl Linnaeus in 1758. The human brain is a complex structure made up of millions of neurons which function by conducting signals. The term artificial intelligence was coined by John McCarthy in 1956.¹ Allan Turner one of the founders of AI defined it as the ability to achieve human-level performance in cognitive tasks by computers.² It

is a branch of computer science dedicated to the development of computer algorithms to accomplish tasks traditionally associated with human intelligence, such as the ability to learn and solve problems.²

Artificial Intelligence may imitate or replicate cognitive human qualities such as rational thinking, learning and problem cracking. It is trying to bring about many revolutionary changes in the modern world. Artificial Intelligence has

made its way into a wide variety of markets such as healthcare, law, education, finance and so on and has the potential to transform the current working scenario provided if we keep ourselves flexible enough to incorporate it in our day to day system.

While the advances in Artificial Intelligence like neural networking, natural language processing, image recognition, and speech recognition have transformed the field of medicine and dentistry in many ways, they have a number of drawbacks and challenges that are yet to be overcome.³ Use of Artificial Intelligence would not just decrease the workload but can also increase the work efficiency. It can have both pros and cons. Artificial Intelligence includes Machine learning, representation learning and deep learning.



Hierarchy of Artificial Intelligence fields²

Artificial Intelligence in Dentistry:

Artificial Intelligence in dentistry once considered a myth is now turning into a reality. In the field of dentistry, Artificial Intelligence is slowly paving its space in the field of pathology and radiology for diagnostic purpose. It helps in data collection which can be used to compare and come to a relative and rapid diagnosis. In conservative dentistry and prosthodontics, it is used in CAD-CAM techniques for precise design and fitting of a prosthesis. In orthodontics, Artificial Intelligence driven orthodontic treatment is on a breakthrough. The Dental chair which is an integral part of our daily practice saw a remarkable alteration from manual pump style to electric chairs with sensors.⁴ Not just this,

newer technologies are also building chairs with voice control command.⁴

Innovative techniques like natural language processing, image recognition, neural networking and speech recognition are on a hike the investment cost can often be a constraint.⁵

The research in the field of application of AI in dentistry and medicine has been extravagant. Implementation and adaption of this technology is the need of the hour for an efficient healthcare facility in our country. No published information exists on the consideration of AI being incorporated in the daily practice of the dental practitioners. The aim of this cross-sectional survey was to understand the knowledge and understanding of AI amongst undergraduate and post graduate dental practitioners in India. Also, to identify the extent AI can be amalgamated into the workplace of dentists and to investigate the advantages and disadvantages of the same.

Methodology:

A set of 45 close ended questions was composed in a web-based questionnaire (Google forms) and distributed to Indian dentists. Answers to all questions were anonymous and grouped such that general information was gathered initially, followed by branching of the survey into two sections depending on the qualification of the dentist. The results were compiled, and statistical analysis was performed in order to explore any correlation between various demographic variables and the answers provided.

Result and Discussion:

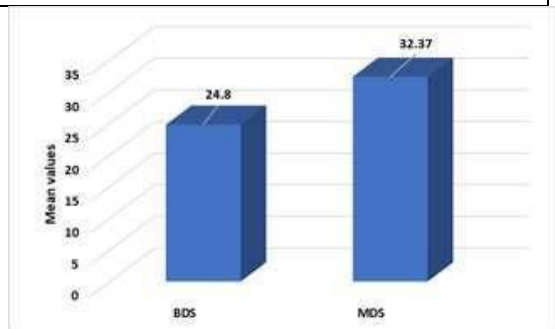
A surplus of advancements in the field of technology during the last few decades have integrated these technological advancements in our day to day life.⁶ Many studies have been done to check the efficacy of inculcation of AI in our routine dental diagnosis and treatment.

The cross-sectional study conducted amongst 104 participants showed a mean age of 28.73 ± 5.72 years. There was no statistically significant difference seen age wise and gender wise. (Table 1 & Graph 1) Majority of the study participants (70) were aware about Artificial Intelligence. Among those who were aware of AI, 57.1% were MDS and 42.9% were BDS and this difference

was statistically significant. When asked about understanding of Artificial Neuronal Network and Deep Learning, majority of the BDS study participants answered “No “, however almost equal response was seen among MDS study participants. When asked regarding the willingness to incorporate AI in daily practice, majority of the study participants answered maybe, amongst which majority were BDS (62.5%). Among MDS study participants, almost half were willing to incorporate AI in daily practice. There was significant difference seen. However, there was no statistically significant difference seen when asked about whether AI could be used in teaching and evaluation between the two groups. Majority of the study participants agreed that AI can be used in teaching and evaluation. When asked about bias free evaluation, majority of the study participants were not sure.

Table 1: Demographics of the study population				
Demographics		Qualifications		p
		BDS [n= 50]	MDS [n= 54]	
Age (Mean ± SD)		24.80 ±3.14	32.37±5.15	~0.07
Gender (n)	Male	18	26	#0.15
	Female	32	28	

~Mann Whitney U test; #Chi-square test,
*Statistically significant, p<0.05



Graph 1: Age distribution of the study population

While discussing about the advantages of AI, 70.3% of the study population said that AI could improve work efficiency, 40.5 % also said that it would improve the health research productivity. 54.1 % of the study population also believed that AI would reduce the chances of error and 52.7 % thought that it would decrease the workload on dentists. Regarding reduction of malpractice in healthcare practice only 29.7% of the populous studied gave a positive response.

Coming to the shortcomings, a good 85.1% believed that incorporation of AI would increase the expenditure. 43.2% thought that AI could not be that effective in India due to lack of recorded data in our country whereas only 6.8% believed that digitization would be impossible. Also, 56.8% of the study populous believed that the complex diagnostic tools cannot be categorized in binary variables (yes or no). Shortage of available experts which could also be a technological constraint in India was seen in 54.1% of the responses. Well, dental public datasets need to be constructed and data standardization is necessary for clinical application of deep learning in dental field.⁷

When asked whether they thought that incorporation of Artificial Intelligence would lead to reduction in the number of jobs for dentists, more participants disagreed than agreeing on it. (Figure 1) It comes out as a positive response to incorporation of AI in the daily clinical practice.

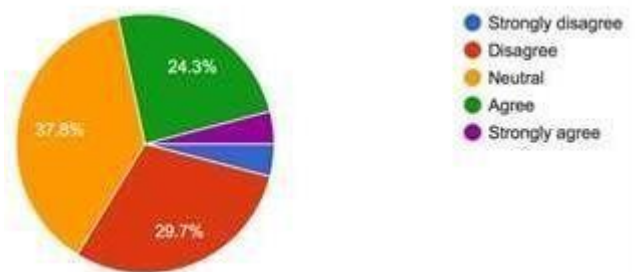
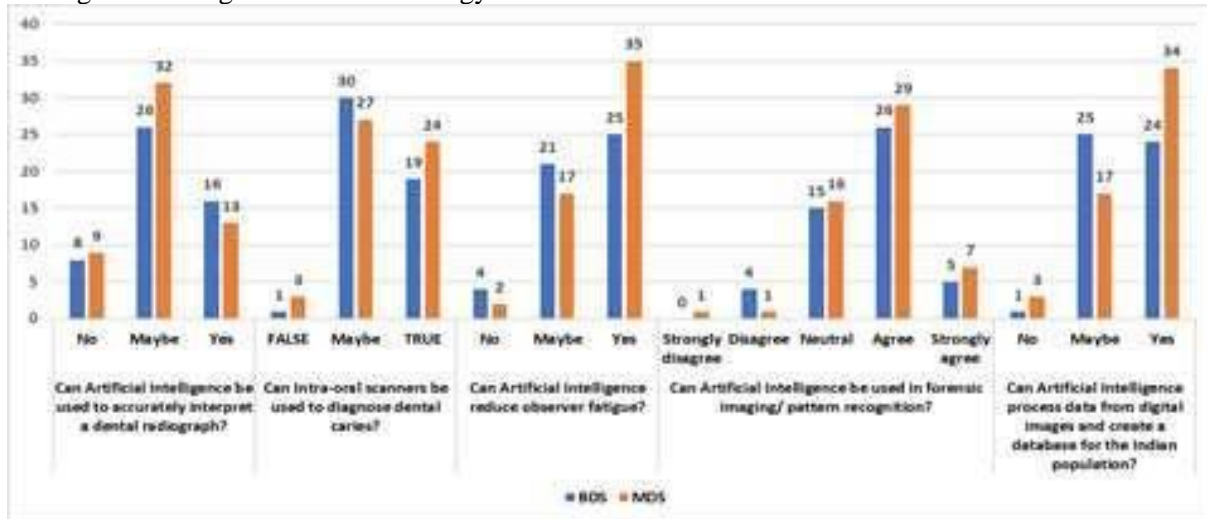


Figure 1: Pie Chart on incorporation of Artificial Intelligence would lead to reduced job opportunities

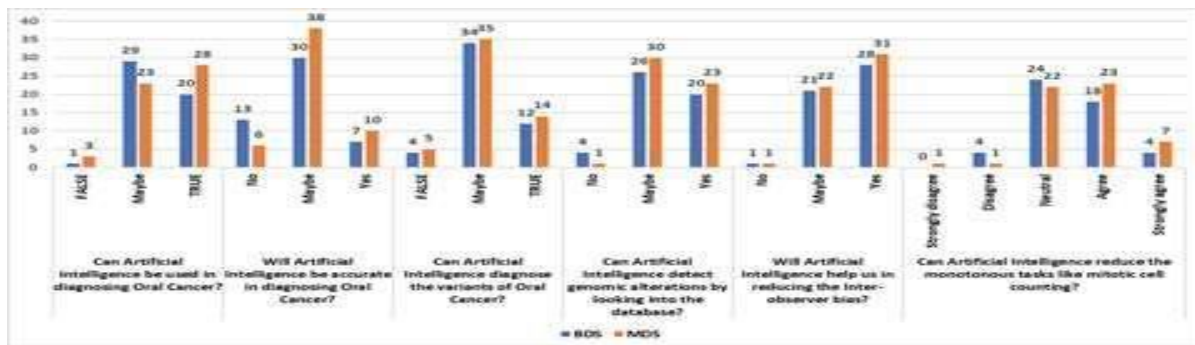
When questions were answered regarding role of AI in oral radiology, there was no statistically significant difference seen among BDS and MDS

study participants. Majority of them were unsure about its role in Oral radiology. Even though the speeded espousal of digital pathology in clinical practice has helped in new prospects⁸, similar results were seen when study participants were asked questions regarding role of Artificial Intelligence in diagnostic Oral Pathology. A

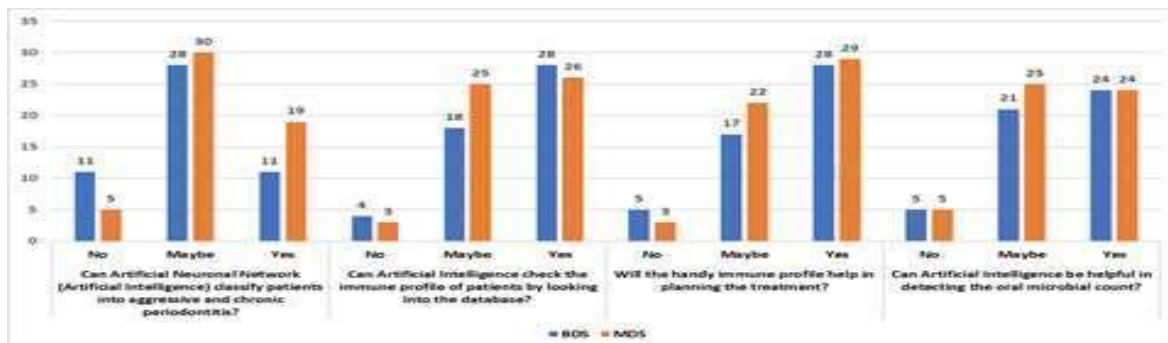
dispassionate response was observed when asked about the role of Artificial Intelligence in different dental departments like Periodontology, Conservative Dentistry & Endodontics, Oral Surgery, Prosthodontics, Orthodontics, etc. (Graph 2-8)



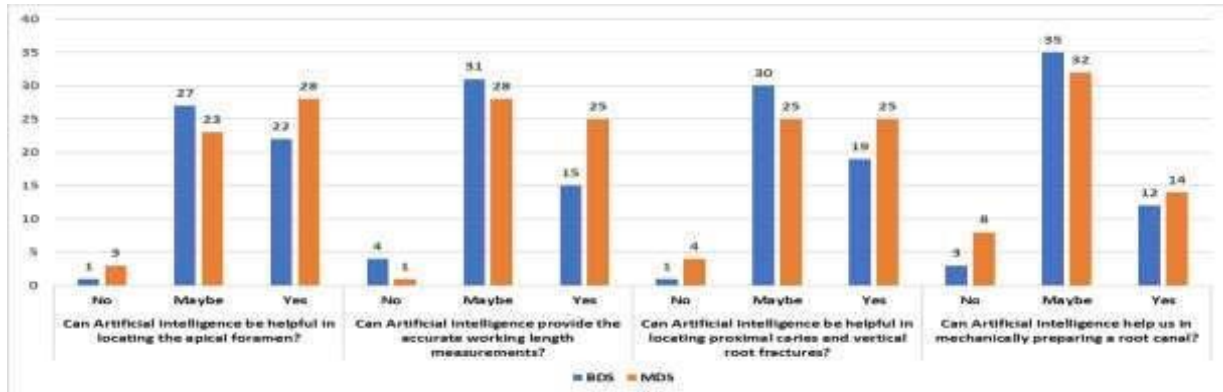
Graph 2: Comparison of study population based on questions regarding the role of Artificial Intelligence in Oral Radiology.



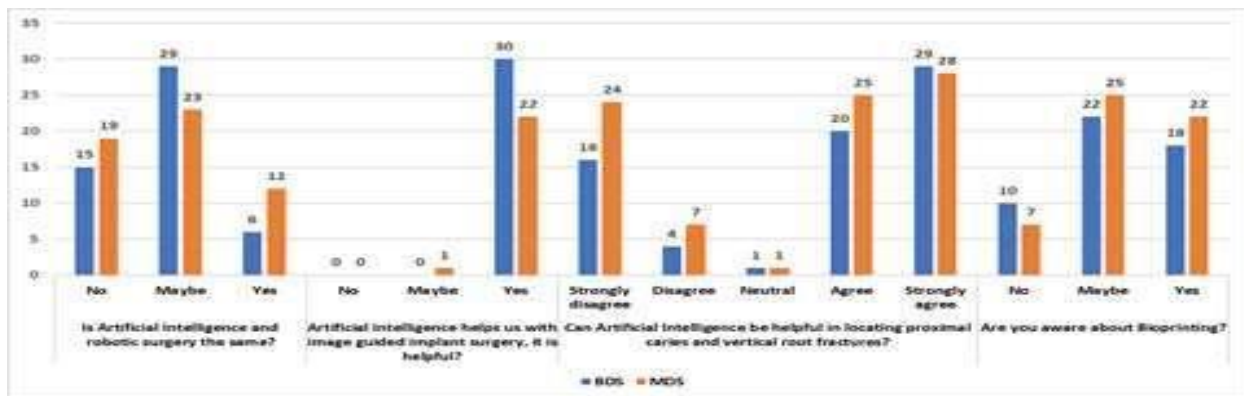
Graph 3: Comparison of study population based on questions regarding the role of Artificial Intelligence in Oral Pathology.



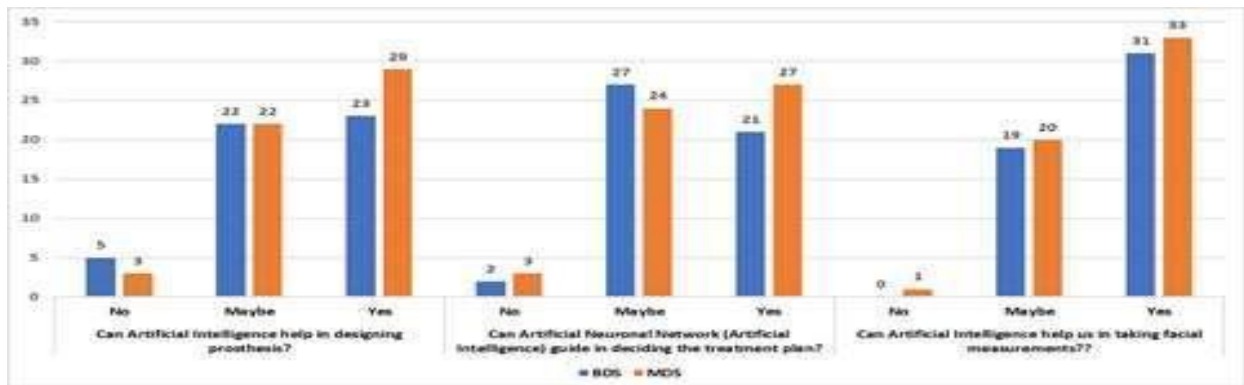
Graph 4: Comparison of study population based on questions regarding the role of Artificial Intelligence in Periodontology.



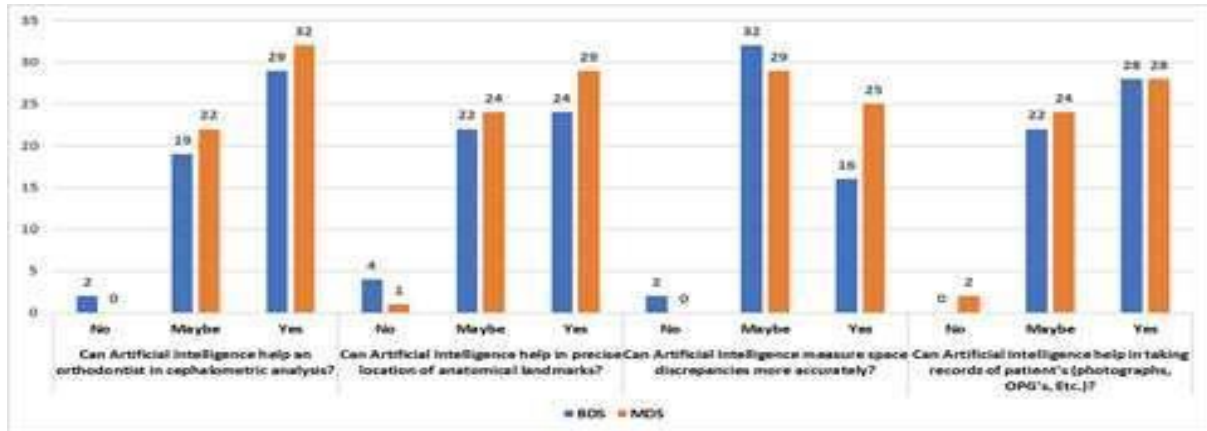
Graph 5: Comparison of study population based on questions regarding the role of Artificial Intelligence in Conservative Dentistry & Endodontics.



Graph 6: Comparison of study population based on questions regarding the role of Artificial Intelligence in Oral Surgery.



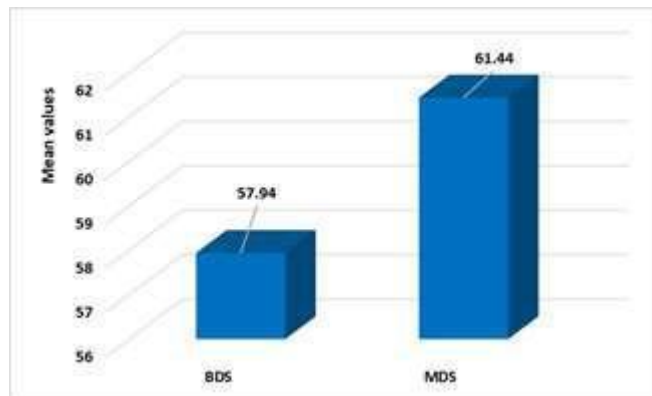
Graph 7: Comparison of study population based on questions regarding the role of Artificial Intelligence in Prosthodontics.



Graph 8: Comparison of study population based on questions regarding the role of Artificial Intelligence in Orthodontics.

When overall knowledge and understanding of Artificial Intelligence was measured, the mean score of MDS study participants was significantly higher than BDS study participants. (Table 3 & Graph9)

Table 3: Overall knowledge and understanding of the study population regarding AI			
Demographics	Qualifications		p
	BDS [n= 50]	MDS [n= 54]	
Overall score (Mean ± SD)	57.94±12.50	61.44±11.40	0.04*
Mann Whitney U test; *Statistically significant, p<0.05			



Graph 9: Overall knowledge and understanding of the study population regarding AI

CONCLUSION:

“I often tell my students not to be misled by the name ‘AI’ there is nothing artificial about it, AI is made by humans, and ultimately to impact human lives and human society.” - Fei Fei Li⁵

The concept and belief of Artificial Intelligence is by no means futuristic now. It's all in the present. The research in the field of Artificial Intelligence is on a quantum leap. Its almost dramatic with the invent of robots for surgeries, tools for cancer detection and voice control dental chairs. It's high time we increase our knowledge and get more aware about the new inventions. Overall, respondents carried a positive attitude towards

Artificial Intelligence with a majority showing interest and excitement for the incorporation of Artificial Intelligence in dentistry. Even though with the job scarcity for dentists in the present time, not many participants showed concerns on job displacement and replacement. Artificial Intelligence can only succor the doctor in executing the tasks efficiently, but in no way replace the human brains ability for a successful diagnosis, treatment planning or even the treatment per say. It can definitely change/improve the way patients are given dental care in the present day.

Despite a small sample size, we discovered a varied amount of views, interest and concerns related to Artificial Intelligence in healthcare. Therefore, a larger group of dentists should be surveyed and evaluated for better knowledge and understanding of the role of Artificial Intelligence in dentistry and hence aim to improve the overall healthcare delivery to the community.

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Nil.

Conflicts of interest-

There are no conflicts of interest.

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