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ARTIFICIAL INTELLIGENCE IN DENTISTRY: THE ETHICAL AND REGULATORY ISSUES

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ABSTRACT:
The quick development of artificial intelligence (AI) in the biomedical and clinical fields is seen as a great strategy in many nations. Artificial intelligence (AI) technologies have completely changed the dental industry, which includes imaging, electronic medical records (EMR), laboratory diagnostics, treatment, data storage, and access for health organizations. Nevertheless, despite AI's great potential and rapid advancement in the medical and healthcare industries, this achievement has raised new ethical concerns. Because of this, we should be aware that its disadvantages can outweigh its benefits. There is currently a lack of specific laws in healthcare settings to address potential ethical and legal issues arising from the use of artificial intelligence. In an attempt to address these significant concerns, this assessment places a focus on how crucial it is to safeguard all beneficiaries, preserve privacy, and resolve cybersecurity risks.

INTRODUCTION:

All areas of dentistry could undergo a transformation thanks to artificial intelligence (AI), including workflow optimization, clinical applications, and the use of health apps to diagnose and treat ailments. Reaching a patient with AI is no longer a matter of "if"; rather, it's a matter of "how" and "now!" We are at a transitional phase as artificial intelligence is being used in dentistry for a number of purposes. Transitions bring both opportunity and difficulties.Nonetheless, the rapid advancement of technology will always outpace the ability of rules and regulations

to keep up. It is necessary to have constantly evolving, modern, user-friendly, and simple regulatory criteria that encourage adherence and compliance

UNDERSTANDING ARTIFICIAL INTTELLIGENCE :

A collection of technologies known as artificial intelligence (AI) allow machines to carry out tasks like perception, learning, problem-solving, and decision-making.Among the subtypes of artificial intelligence (AI) is machine learning (ML), which has become the most often used method for AI healthcare applications in the recent past since it enables computational systems to learn from data and perform better without the need for explicit programming.A branch of machine learning called deep learning uses multiple-layered artificial neural networks to find patterns in enormous datasets[1]

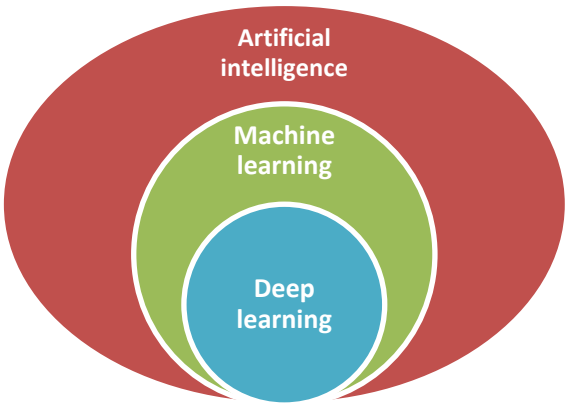

Figure 1 : Subtypes of Artificial intelligence

APPLICATIONS OF AI IN DENTISTRY:[2]

APPLICATION	TECHNOLOGY
Prosthodontics	Implant - Implant systems can be detected from panoramic radiographic images Maxillofacial prosthetics – Bionic eye ,bionic finger
Radiology	CNN - For the detection and diagnosis of dental caries,To identify anatomical structures
Orthodontics	ANN – For clinical decision making
Periodontics	CNN – Diagnosis of periodontally compromised teeth ANN – Accurate diagnosis of aggressive periodontitis and chronic periodontitis
Endodontics	CNN – For assessing the root canal configurations and to classify morphology
Oral pathology	CNN – Diagnosis of head and neck cancer lesion, Detecting tumoural tissues in tissue samples or on radiographs

REGULATORY AND ETHICAL ISSUES:[3]

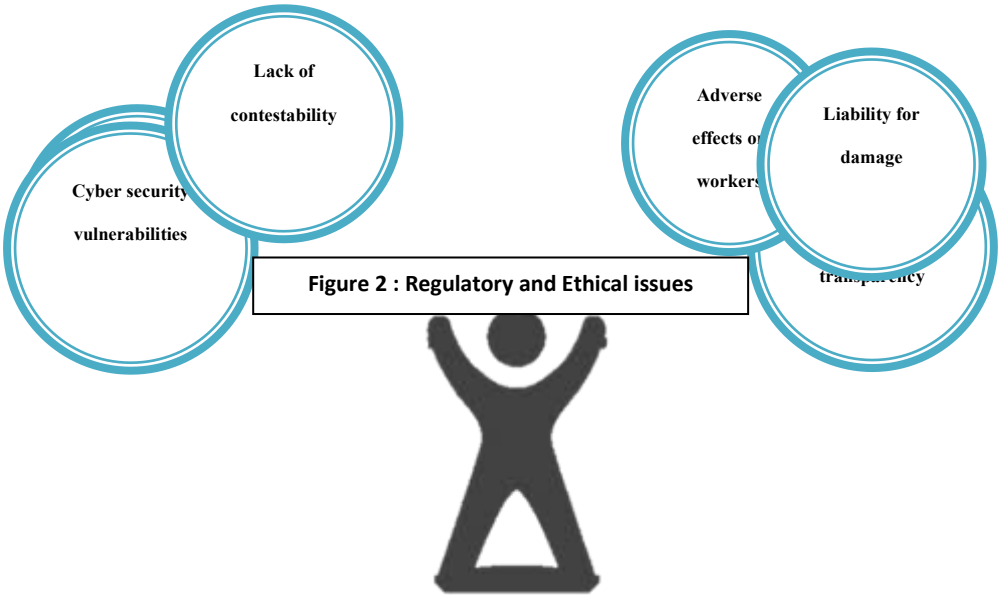

Figure 2 : Regulatory and Ethical issues

Insufficient Algorithmic Transparency

Not Enough Algorithmic One basic issue that has dominated conversations around AI law is transparency. Regarding the kind of data they utilize and any software issues, AI developers should be quite transparent for the sake of patient safety and trust. In addition to lowering cybersecurity risk, there may be justifiable worries about safeguarding investments and intellectual property when all data and algorithms are made public. Algorithms are not patentable in India.

Solution:

Auditing by a third party or the government could be a viable option[5]

Cyber security vulnerabilities:

Cybersecurity is another problem with AI in dentistry. In order to protect the confidentiality of a patient's medical record, a doctor is required by law to delete specific information from it. When an AI-based clinical decision is incorporated into clinical treatment, it will get harder to withhold information from electronic records[6]

Solution:

Block chain technology (BCT)[7], an open-source software that permits the creation of huge, decentralized, and secure public databases with ordered entries arranged in a block structure, could be a feasible solution.

Unfairness, bias and discrimination:

In industries where algorithms and automated decision-making systems are employed, such as employment, credit, criminal justice, and insurance, unfairness, bias, and discrimination have frequently come up as issues and have been recognized as a major difficulty[8]. Biased AI may put certain subpopulations' safety at risk by producing false positives and inefficient therapies. Increased data availability, improved efforts to get information from underrepresented groups, and more precise definitions of the populations for which the algorithm is or is not appropriate may help to mitigate some biases. Some biases may be addressed as a result of increased data availability, initiatives to better gather data from underrepresented groups, and clarification of whose populations the algorithm is or is not appropriate for[9].

Solution:

Developers should consider the risk for biases when deciding (1) which ML technologies/procedures they want to use to train the algorithms and (2) what datasets (including considering their quality and diversity) they want to use for the programming.

Lack of contestability:

One of the goals that transparency supports is individual contestability, which is the cornerstone of legal rights that grant access to personal data and insight into the decision-making procedures used to categorize them[5]. A

contestability-designed system would uphold the right to challenge a particular result in accordance with consumer protection and privacy

Solution:

Contestability by design has been proposed as an approach to better protect the rights of decisions based solely on automated processing as a requirement at each stage of an artificial intelligence system's lifecycle.

Intellectual property issues:

It is costly and dangerous to integrate AI and big data into secure and efficient "real-world" goods, services, and procedures. AI presents a number of intellectual property concerns, including ownership of works or innovations created by AI, ownership of datasets, liability for AI-generated creativity and innovation, and rights or other legal restrictions.

Solution:

AI and the dataset can be protected by various intellectual property rights (IPRs), typically involving a combination of long contracts, copyright, trade secrets or the law of confidence[10].

Adverse effects on workers:

Concerns about AI and automation in the workplace are widespread.The major issues are: integration of unskilled workers into the "new" job market; inequality in the "new" job market; changes in future employee requirements; decreased demand for labor; labor relations; the creation of new job structures and types of jobs; employee dismissal; labor relations; health and safety issues; impact on working time; and social security issues[3]. These problems have the potential to significantly affect human rights in addition to having social and economic ramifications.

Solution:

Modernisation of education, at all levels, and provides them with the opportunity to acquire the skills they need.

Liability for damage:

People and property may sustain harm as a result of the application and deployment of AI technologies. This is something that needs to be handled cautiously[5].

Solution:

Liability challenges should be mapped, and a risk management strategy should be implemented[1].

S.NO	REGULATORY AND ETHICAL ISSUES	ACT AND LAWS		
		USA	**EUROPE**	**INDIA**
1.	**Lack of Algorithmic transparency**	Algorithmic Accountability Act (2019).	1. Digital Markets Act 2. Digital Services Act	Digital Information Security in Healthcare Act (DISHA)
2.	**Cyber security vulnerabilities**	1. The Cyber security and Infrastructure Security Act of (2018) 2. Data Protection Act of (2021)	The new Cyber security Act (2019)	Information Technology Act, 2000 (ITA)
3.	**Unfairness, bias and discrimination**	1. Fair Credit Reporting Act 2. Equal Credit Opportunity Act 3. Age Discrimination in Employment Act	UK Equality Act (2010)	
4.	**Lack of contestability**		European Union data protection law (2016)	
5.	**Intellectual property issues**	Copyright law (1976) Database protections and trade secret law	1.EPO Case law 2.Competition law	1. Copyright Act, (1957) 2. Patents Act (1970)
6.	**Adverse effects on workers**	1.Americans with Disabilities Act 2.Age Discrimination in Employment Act		

7.	**Liability for damage**		Civil Law Rules on Robotics (2015)	

CONCLUSION:

As AI technologies develop, there will be ramifications for human rights, legal issues, and vulnerabilities that need for constant observation and research. Technological progress will be driven by data-driven innovation and intelligent machines that can replace or supplement human talent[11]. AI is currently the subject of intense discussion, but it is anticipated that when technologies converge and new advances arise, this will change. when a result, new and original legal and societal value conundrums will need to be addressed, necessitating renewed discourse.

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