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Knowledge and Awareness About the Emerging Trends in Oral Radiology Among Dental Students

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Abstract: Background: Oral radiology plays a crucial role in dental practice, with emerging trends such as 3D imaging, artificial intelligence (AI) integration, and tele-dentistry reshaping the field. This study aimed to assess the knowledge and awareness of these trends among dental students.
Methods: A cross-sectional survey was conducted among 104 dental students in Chennai, using a structured questionnaire. The participants included undergraduate and postgraduate students. Data were collected through online platforms and analysed using PSPP 3.0 software.
Results: The study revealed that 48.1% of participants had some awareness of recent advancements in dental imaging. 30.1% correctly identified 3D imaging, AI integration, and tele-dentistry as emerging trends. Of these, 29.2% were familiar with all three trends, with AI integration being the most recognized at 34.6%. Notably, 41.3% engaged in monthly learning to stay updated, though 13.3% never did. 25% strongly agreed that CBCT should be used routinely. For tele dentistry, 31.5% recognized improved patient convenience, and nearly 40% believed it should be integrated into oral medicine practices.
Conclusion: Dental education programs need to ensure comprehensive exposure to these trends. Efforts to improve knowledge, address adoption barriers, embrace tele dentistry, and prepare for the evolving role of AI are crucial. This study provides insights to guide dental education and practice in this rapidly evolving field.
Keywords: Dental students, oral radiology, 3D imaging, artificial intelligence, tele-dentistry.

I. INTRODUCTION

Oral radiology is a fundamental component of dental practice, serving as an indispensable tool for the diagnosis, treatment planning, and monitoring of oral and maxillofacial conditions. It empowers dental professionals with the ability to visualize structures within the oral cavity, facilitating early detection and accurate assessment of dental and craniofacial abnormalities. However, the field of oral radiology has undergone a remarkable transformation in recent years, characterized by the emergence of innovative technologies and techniques that have revolutionized the way dental imaging is conducted.[1,2] It is imperative for dental students, as the future custodians of oral health, to remain abreast of these cutting-edge developments in oral radiology. The traditional methods of radiography, such as intraoral and panoramic radiographs, have been supplemented, and in some cases, supplanted, by state-of-the-art advancements like cone-beam computed tomography (CBCT), digital radiography, 3D imaging, and artificial intelligence-assisted radiological interpretation.[3,4] These emerging trends offer unprecedented precision, enhanced diagnostic capabilities, and reduced patient exposure to ionizing radiation, all of which contribute to a more comprehensive and patient-centric approach to oral healthcare.[5] In this context, dental students must not only possess a foundational understanding of conventional radiological techniques but also be well-versed in the applications, advantages, and limitations of these emerging technologies. This study embarks on a comprehensive exploration of the knowledge and awareness of dental students concerning the emerging trends in oral radiology.

II. MATERIALS AND METHODS

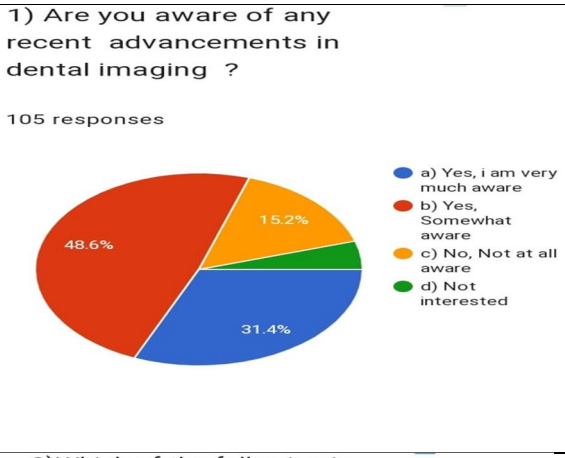
A questionnaire survey was conducted among dental students involving both undergraduates and postgraduates in a privately dental college situated in Chennai. A total of 104 participants willingly agreed to take part in this study. We employed a carefully designed survey questionnaire (Table 1) that consisted of 15 questions pertaining to their understanding and awareness of emerging developments in oral radiology.

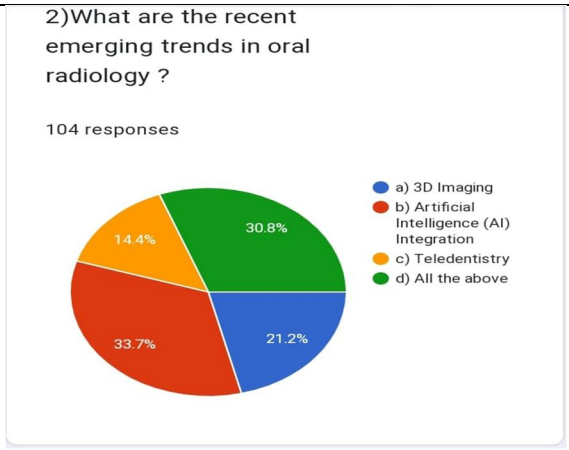
To collect responses, we utilized Google Forms and shared the questionnaire via different social media platforms. After data collection, we transferred the gathered information into an Excel spreadsheet for further analysis. The data analysis was carried out using PSPP 3.0 software. Any p- value less than 0.05 was considered statistically significant.

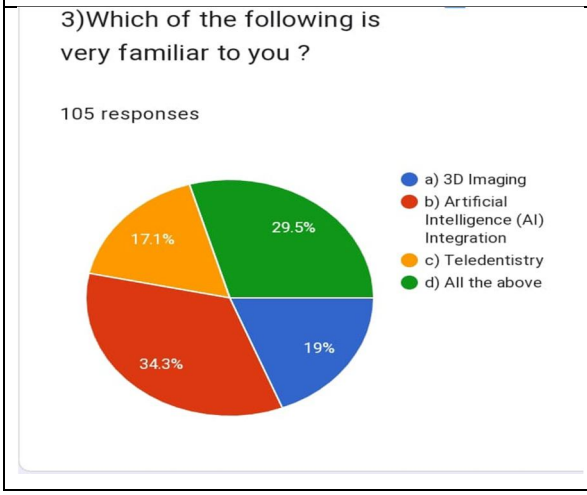
III. RESULTS

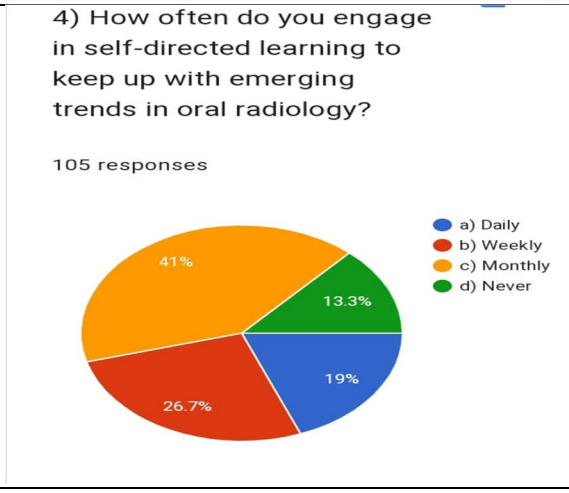
Among the participants, 31.1% were house-surgeons (CRRI), and 26.2% were postgraduates. Mean age of participants was 23 years. 48.1% of the participants had some level of awareness regarding recent advancements in dental imaging Approximately 30.1% of the respondents identified 3D imaging, artificial intelligence integration, and tele-dentistry as recent emerging trends, with p-values of 0.2304, 0.2407, and 0.2816, respectively, indicating that these observations were not statistically significant. However, 29.2% of participants were familiar with all three trends, while 41.3% engaged in monthly learning to stay updated, both of which were not statistically significant with p-values of 0.2407 and 0.2816. On the other hand, 33.7% recognized the advantages of cone-beam computed tomography (CBCT) over traditional 2D radiography (p-value: 0.0145), and 25% strongly supported regular CBCT usage (p-value: 0.0473). Additionally, 39.4% found that artificial intelligence streamlines administrative tasks (p-value: 0.0422), and a majority (51%) believed in its selective integration (p-value: 0.0088). Furthermore, 31.5% considered improved patient convenience as the primary advantage of teledentistry (p-value: 0.0007), with 39.8% supporting its routine integration (p-value: 0.0004) and 47.1% recognizing its role in oral health education and preventive care (p-value: 0.003). However, obstacles to CBCT adoption included radiation concerns (p-value: 0.2289) and equipment costs (p-value: 0.1793). Lastly, 35.9% believed that AI had the potential to enhance patient outcomes (p-value: 0.0082), and 38.8% expected significant changes in the role of oral radiologists (p-value: 0.0051) in the future.

RESULTS



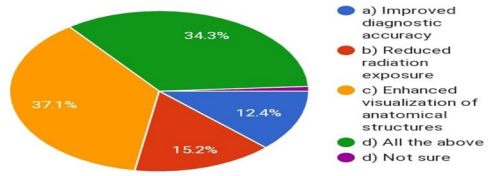






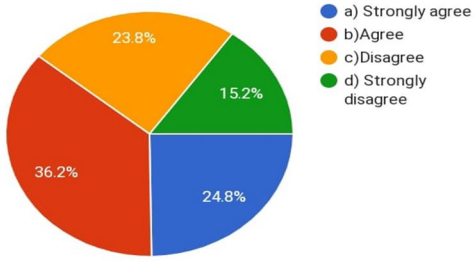
5) In your opinion, what is the primary advantage of CBCT over traditional 2D radiography in oral radiology?

105 responses



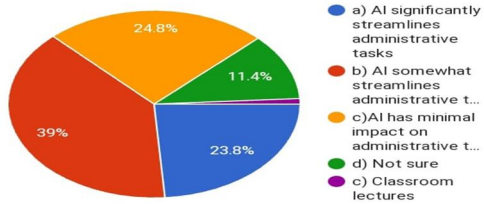
6)Do you believe that CBCT should be routinely used in dental practices for various diagnostic purposes?

105 responses



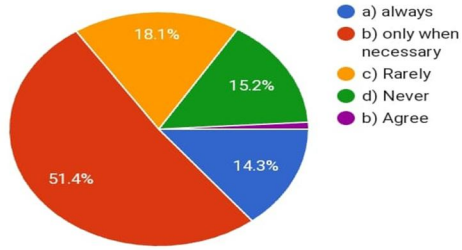
7) How do you view the role of AI in automating administrative tasks in oral medicine, such as appointment scheduling and record keeping?

105 responses



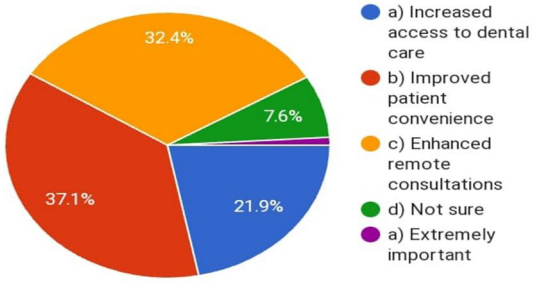
8)How often do you believe AI should be integrated into routine oral medicine examinations and procedures?

105 responses



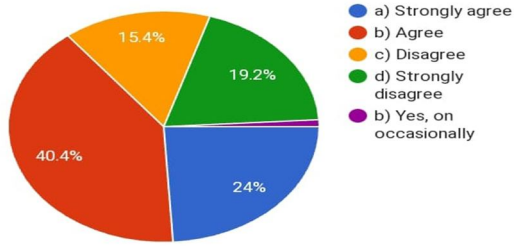
9)In your opinion, what is the primary advantage of teledentistry in oral medicine?

105 responses



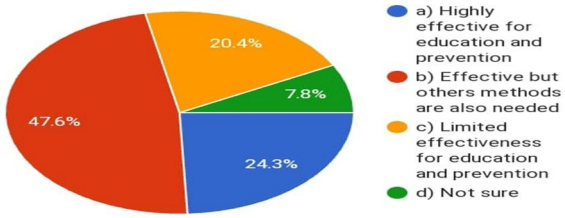
10)Do you believe that teledentistry should be routinely integrated into oral medicine practices for various consultations and diagnoses?

104 responses



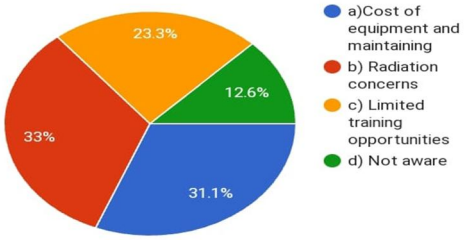
11)what is your view on the role of tele dentistry in providing oral health education and preventive care to patients ?

103 responses



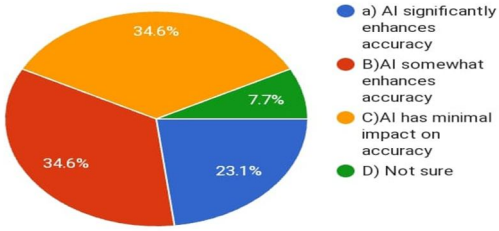
12) In your view , what are the primary obstacles to the widespread adoption of CBCT in dental practice?

103 responses



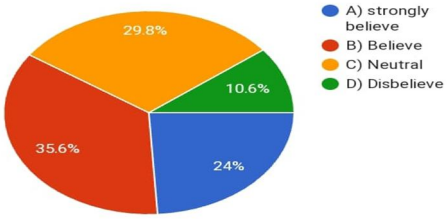
13) How do you perceive the role of AI integration in enhancing the accuracy in oral radiology diagnosis and treatment planning?

104 responses



14) Do you believe that AI in oral radiology has the potential to enhance patient outcomes and treatment planning ?

104 responses



15) Do you beleive that AI will significantly change the role of oral radiologist in future ?

104 responses

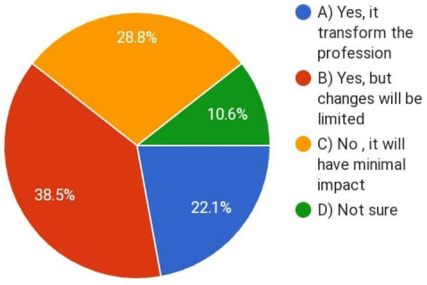


Table 1

	N	%	Chi-Square ratio	p-value
1. **Are you aware of any recent advancements in dental imaging?**			3.55	0.2304
- a) Yes, I am very much aware	33	31.4%		
- b) Yes, Somewhat aware	51	48.6%		
- c) No, Not at all aware	16	15.2%		
- d) Not interested	5	4.8%		
2. **What are the recent emerging trends in oral radiology?**			4.55	0.2407
- a) 3D Imaging	22	21.2%		
- b) Artificial Intelligence (AI) Integration	35	33.7%		
- c) Teledentistry	15	14.4%		
- d) All the above	32	30.8%		
3. **Which of the following is very familiar to you?**			3.82	0.2816
- a) 3D Imaging	20	19%		
- b) Artificial Intelligence (AI) Integration	36	34.3%		
- c) Teledentistry	18	17.1%		
- d) All the above	31	29.5%		
4. **How often do you engage in self-directed learning to keep up with emerging trends in oral radiology?**			10.54	0.0145
- a) Daily	20	19%		
- b) Weekly	28	26.7%		
- c) Monthly	43	41%		
- d) Never	14	13.3%		
5. **In your opinion, what is the primary advantage of CBCT over traditional 2D radiography in oral radiology?**			7.94	0.0473
- a) Improved diagnostic accuracy	13	12.4%		
- b) Reduced radiation exposure	16	15.2%		
- c) Enhanced visualization of anatomical structures	39	37.1%		
- d) All the above	36	34.3%		
6. **Do you believe that CBCT should be routinely used in dental practices for various diagnostic purposes?**			8.19	0.0422
- a) Strongly agree	26	24.8%		
- b) Agree	38	36.2%		
- c) Disagree	35	23.8%		
- d) Strongly disagree	16	15.2%		
7. **How do you view the role of AI in automating administrative tasks in oral medicine, such as appointment scheduling and record keeping?**			11.61	0.0088
- a) AI significantly streamlines administrative tasks	25	23.8%		
- b) AI somewhat streamlines administrative tasks	41	39%		
- c) AI has minimal impact on administrative tasks	26	24.8%		
- d) Not sure	12	11.4%		

8. **How often do you believe AI should be integrated into routine oral medicine examinations and procedures?**			16.89	0.0007
- a) Always	25	24.3%		
- b) Only when necessary	41	47.6%		
- c) Rarely	29	20.4%		
- d) Never	8	7.8%		
9. **In your opinion, what is the primary advantage of teledentistry in oral medicine?**			18.22	0.0004
- a) Increased access to dental care	15	14.3%		
- b) Improved patient convenience	54	51.4%		
- c) Enhanced remote consultations	19	18.1%		
- d) Not sure	16	15.2%		
10. **Do you believe that teledentistry should be routinely integrated into oral medicine practices for various consultations and diagnoses?**			13.92	0.003
- a) Strongly agree	23	21.9%		
- b) Agree	39	37.1%		
- c) Disagree	24	32.4%		
- d) Strongly disagree	8	7.6%		
11. **What is your view on the role of tele-dentistry in providing oral health education and preventive care to patients?**			4.32	0.2289
- a) Highly effective for education and prevention	25	24%		
- b) Effective but other methods are also needed	42	40.4%		
- c) Limited effectiveness for education and prevention	16	15.4%		
- d) Not sure	21	19.2%		
12. **In your view, what are the primary obstacles to the widespread adoption of CBCT in dental practice?**			4.9	0.1793
- a) Cost of equipment and maintaining	32	31.3%		
- b) Radiation concerns	34	33%		
- c) Limited training opportunities	24	23.3%		
- d) Not aware	13	12.6%		
13. **How do you perceive the role of AI integration in enhancing the accuracy in oral radiology diagnosis and treatment planning?**			6.51	0.0893
- a) AI significantly enhances accuracy	24	23.1%		
- b) AI somewhat enhances accuracy	36	34.6%		
- c) AI has minimal impact on accuracy	36	34.6%		
- d) Not sure	8	7.7%		
14. **Do you believe that AI in oral radiology has the potential to enhance patient outcomes and treatment planning?**			11.77	0.0082
- A) Strongly believe	24	24%		
- B) Believe	37	35.6%		
- C) Neutral	31	29.8%		
- D) Disbelieve	11	24%		

15. **Do you believe that AI will significantly change the role of oral radiologists in the future?**			12.8	0.0051
- A) Yes, it will transform the profession	23	22.1%		
- B) Yes, but changes will be limited	40	38.5%		
- C) No, it will have minimal impact	30	28.8%		
- D) Not sure	11	10.6%		

IV. DISSCUSSION

One of the central findings of the study is the varying degrees of awareness among participants regarding emerging trends in oral radiology. A significant proportion (48.1%) demonstrated some level of awareness, indicating that many dental students have been exposed to these trends. However, there is room for improvement in enhancing awareness. The study highlighted that a substantial portion (30.1%) of participants correctly identified 3D imaging, artificial intelligence integration, and tele-dentistry as recent emerging trends in oral radiology. Furthermore, 29.2% were familiar with all three trends, with artificial intelligence integration being the most recognized at 34.6%. These findings underscore the importance of students staying informed about these contemporary developments. An encouraging observation is that a significant number of participants (41.3%) engaged in regular learning activities to stay updated with emerging trends. However, the fact that 13.3% never engaged in such activities indicates a need for more comprehensive and consistent educational efforts to ensure that students remain well-informed. Participants' opinions on the advantages of emerging technologies were diverse. For instance, the recognition of cone-beam computed tomography (CBCT) for improved diagnostic accuracy and reduced radiation exposure indicates an understanding of the benefits of this technology.[6] In the study conducted by Smita Singh Bhardwaj et al., 44.4% of the participants believed that cone-beam computed tomography (CBCT) should be preferred for 3D imaging in dentistry[7], while in our study, it was 31.3%. Similarly, the positive perceptions of artificial intelligence in streamlining administrative tasks and potentially enhancing patient outcomes are noteworthy. The study highlights the perceived convenience of teledentistry by 31.5% of participants. Furthermore, nearly 40% agreed that teledentistry should be routinely integrated into oral medicine practices for consultations and diagnoses. In a study by Nandini Sen et al., 69% agreed that teledentistry is a time-saving approach.[8] In a study by Devina Pradhan, 74.4% of students had knowledge regarding teledentistry, and 79.2% of students contemplated practicing teledentistry in the future.[9] This suggests that dental students recognize the potential of teledentistry in improving access to care and patient convenience. The participants identified common obstacles to the adoption of these emerging trends. For CBCT, concerns about radiation and equipment costs were noted, indicating the importance of addressing these issues to ensure the safe and affordable integration of CBCT into dental practices. Participants expressed their belief in the transformative potential of artificial intelligence in oral radiology. The idea that AI could significantly change the role of oral radiologists in the future, even though the changes are expected to be limited, suggests an awareness of the evolving landscape of dental practice, which was also seen in the studies by Kalaimani G. et al. (63.5%) and Sridhar M. et al. (88.3%).[10,11] Dental education programs need to ensure that students are exposed to and educated about emerging trends in oral radiology to better prepare them for contemporary practice. Efforts should be made to improve knowledge levels, especially among those who do not regularly engage in learning activities. Dental institutions should consider addressing concerns related to the adoption of CBCT and AI to facilitate their wider use in dental practice. Teledentistry could play a significant role in improving patient access to oral healthcare, and dental professionals should be prepared to embrace this technology. The evolving role of AI in oral radiology will require dental students and professionals to adapt and continuously update their skills.

V. CONCLUSION

In conclusion, the study emphasizes the importance of dental education programs in ensuring that students are well-prepared for the dynamic field of oral radiology. Efforts should be made to improve knowledge levels, especially among those who do not actively engage in continuous learning. Dental institutions should consider addressing concerns related to the adoption of emerging technologies to facilitate their wider use in dental practice.

Teledentistry has a significant role to play in enhancing patient access to oral healthcare, and dental professionals should embrace this technology. The evolving role of artificial intelligence in oral radiology necessitates continuous skill development among dental students and professionals. Overall, this study offers valuable insights that can inform and guide dental education programs and dental practice in a rapidly evolving field.

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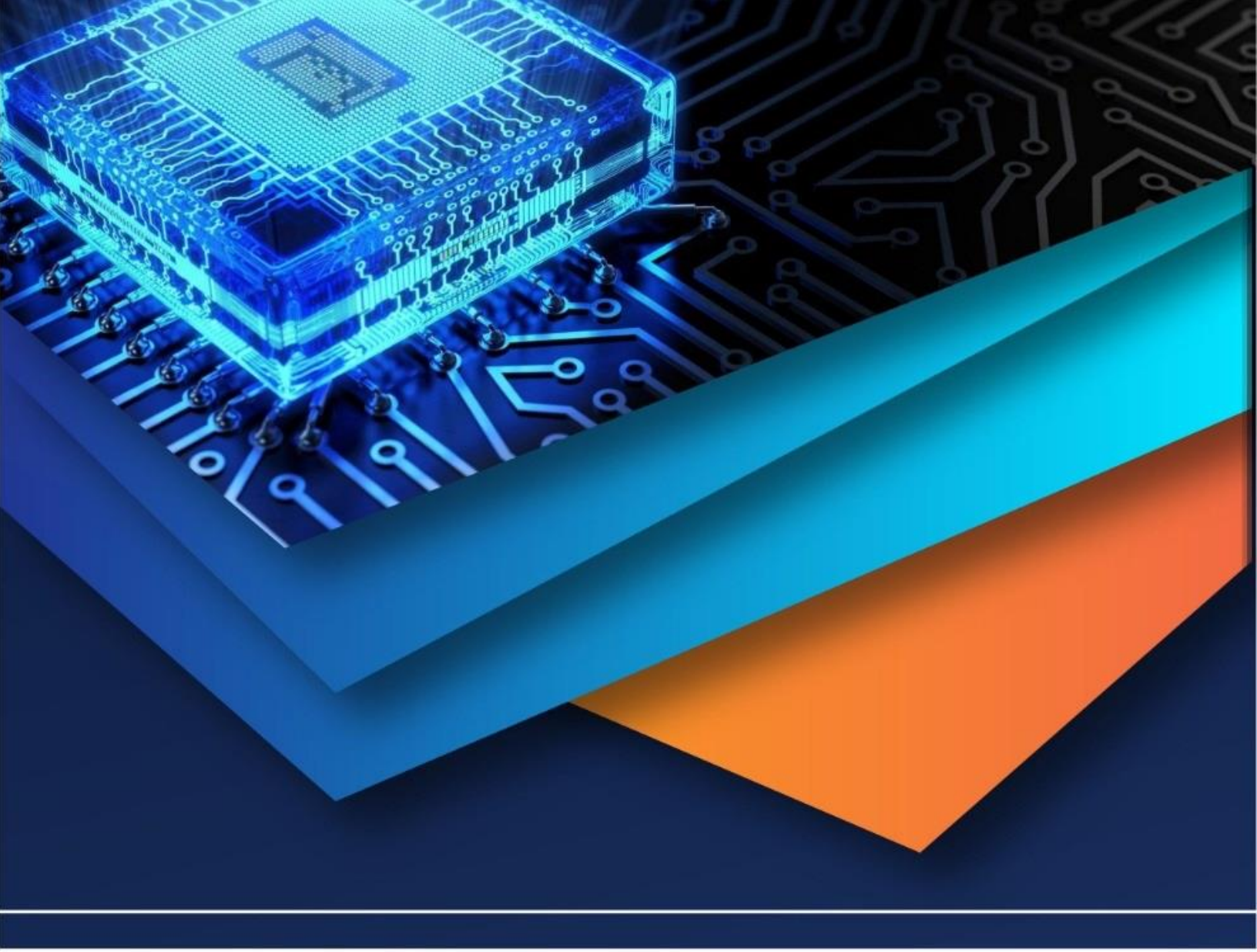

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