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Research

Nano Robotic Dentistry-Transforming Fiction into Reality

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Abstract

Background: Nanotechnology is revolutionizing medicine, and dentistry is no exception. Nano robotic dentistry offers a shift from conventional methods to highly precise, minimally invasive treatments using nanoscale robots for diagnosis, drug delivery, tooth repair, and plaque removal.
Aim: To explore how nano robotic technology is transforming modern dental care through futuristic yet practical applications.
Objectives: To understand the principles and functions of nano robots in dentistry. To examine current and potential clinical applications.
Methodology: A cross-sectional survey was conducted among 200 dental students (43 males, 157 females) across different age groups and years of study. The 15-item questionnaire assessed knowledge of nano robotic applications. Chi-square tests were used to analyze gender, age, and academic year differences.

Keywords: Nanorobotics, dental nanotechnology, minimally invasive dentistry, nano dentistry, targeted drug delivery, dental innovation, robotic dentistry, molecular dentistry, smart dental systems, future of dentistry.

INTRODUCTION

Dentistry has always been at the forefront of medical innovation, constantly evolving to provide safer, more effective, and less invasive treatments. In recent years, the intersection of nanotechnology and robotics has opened up a new frontier in dental care nano robotic dentistry. Once the realm of science fiction, the idea of microscopic robots operating within the human body is now moving toward reality, promising to revolutionize how oral health is managed and treated.

Nano robots, or nanobots, are microscopic devices designed to perform precise tasks at a cellular or even molecular level. In dentistry, these robots hold the potential to transform everything from routine cleanings and

fillings to complex surgeries. They can navigate through the oral environment, identify disease-causing bacteria, deliver medication directly to affected tissues, and even repair or regenerate damaged dental structures. Their small size allows for procedures that are highly targeted and minimally invasive, significantly reducing pain and recovery time for patients.

The application of nanorobotics in dentistry also brings a host of advantages over conventional methods. For example, nano robots can detect early signs of oral diseases, including caries and periodontitis, long before they become visible or symptomatic. They can perform continuous monitoring, offer real-time data, and even respond autonomously to treat emerging conditions. These capabilities could lead to a paradigm shift from reactive to preventive and personalized dental care.

Despite its promising future, nano robotic dentistry is still in its developmental stages. Technical challenges such as biocompatibility, safe navigation within the human body, power supply for nano devices, and cost of development remain significant hurdles. Moreover, ethical and regulatory considerations around patient safety, control, and data privacy must be thoroughly addressed before nano robots can be widely adopted in clinical practice.

In conclusion, nano robotic dentistry is a groundbreaking advancement that holds the potential to redefine modern dental care. As research continues and technology matures, what was once considered fiction is rapidly becoming a reality. This paper explores the principles, applications, benefits, challenges, and future prospects of nano robotics in dentistry, offering insight into how this emerging technology could transform both patient experience and professional practice.

Beyond clinical treatment, nano robotic dentistry has significant implications for dental education, diagnostics, and patient communication. With AI- integrated nano devices, dental professionals could gain real-time insights into patients' oral health at a microscopic level, enabling more accurate diagnoses and customized treatment plans. Such advancements could also improve patient engagement, as visualizations of nano-level processes help in understanding the nature of their conditions and the effectiveness of treatments. As a result, nano robotic dentistry doesn't just promise better outcomes it offers a more transparent, informed, and collaborative approach to oral healthcare.

Methodology

Study Design and Area
A cross-sectional study was carried out at a tertiary care teaching hospital in Khammam.

Study Population
The study population included healthcare students, ranging from third-year to internship dental students, who responded to the offline paper-based questionnaire survey.

Study Instrument
A self-administered questionnaire was designed based on the topic Nano Robotic Dentistry-Transforming Fiction Into Reality. It consisted of 15 questions. Each participant filled in demographic data such as name, age, and year of study. Participants selected one option from the provided answers for each question, which focused on social media use and e-professionalism.

Pilot Study
A pilot study was conducted on a small group of students to assess the validity and reliability of the questionnaire.

Sampling Method
Convenience sampling method was used to select participants for the study.

Inclusion Criteria
Students who were interested in the study and willing to participate were included.

Exclusion Criteria:
Students who were unwilling to participate were excluded from the study.

Organizing the Study
The study utilized a paper-based version of the self-administered questionnaire consisting of 10 questions focusing on knowledge and awareness. It included sections for demographic data (Name, Age, Sex, and Year of Study). Participants were required to answer all questions by selecting one option from the provided answers.

Statistical Analysis
Data collected from the filled questionnaires were tabulated in an Excel worksheet and analyzed using SPSS version 29.

RESULTS

A total of 200 students took part in this with females (78.5%) and male of (21.55%). Age of the participants ranging from 18-25 years. In this study females were more likely to demonstrate perception in dissection room experiences than male. Significantly interns (38.5%) are the one most participated followed by IV BDS (38.0%) followed by III BDS (26.5%).

Age					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Age	200	2	26	22.13	1.638

Gender

	Frequency	**Percent**
MALE	43	21.5
FEMALE	157	78.5
Total	200	100.0

Year of study

	Frequency	**Percent**
III BDS	53	26.5
IV BDS	70	35.0
INTERN	77	38.5
TOTAL	200	100.0

Distribution and comparison of responses based on gender
Based on gender

- 84.0% of female participants have reported correct answer as nano robotic dentistry applications of nano scale robots to diagnose, prevent and treat dental condition than males (76.7%).
- 62.2% females have given the correct answer as consent for the use of nano technology in patient care than 37.8% males.
- 37.2% males think that in next 10 to 15 years the nano robotic dentistry could become a regular part of clinical practice tha 26.1% Females.

Item	**Response**	**Males**		**Females**		**Chi-Square value**	**P value**
		n	%	n	%		
Q1	1	6	13.9	5	3.18	13.915	**0.003***
	2	33	76.7	132	84.0		
	3	6	13.9	15	9.55		
	4	5	11.6	5	3.18		
Q2	1	49	39.6	78	61.4	8.445	**0.038***
	2	31	36.5	54	63.5		
	3	3	13	20	87		
	4	1	10	9	90		
Q3	1	30	33	61	67	5.698	0.127
	2	50	39.1	78	60.9		
	3	3	18.8	13	81.2		
	4	1	10	9	90		
Q4	1	25	27.8	65	72.2	12.493	**0.006***

	2	53	44.2	67	55.8		
	3	5	23.8	16	76.2		
	4	1	7.1	13	92.9		
Q5	1	21	30	49	70	10.422	**0.015***
	2	55	42.6	74	57.4		
	3	6	18.2	27	81.8		
	4	2	15.4	11	84.6		
Q6	1	24	29.6	57	70.4	9.978	**0.019***
	2	56	41.8	78	58.2		
	3	3	13.6	19	86.4		
	4	1	12.5	7	87.5		
Q7	1	27	38	44	62	6.714	0.082
	2	49	37.7	81	62.3		
	3	7	21.2	26	78.8		
	4	1	9.1	10	90.9		
Q8	1	24	34.8	45	65.2	5.352	0.148
	2	56	37.6	93	62.4		
	3	3	16.7	15	83.3		
	4	1	11.1	8	88.9		
Q9	1	22	31.9	47	68.1	7.245	0.064
	2	56	40	84	60		
	3	5	17.9	23	82.1		
	4	1	12.5	7	87.5		
Q10	1	20	29.4	48	70.6	13.179	**0.004***
	2	59	42.8	79	57.2		
	3	4	14.3	24	85.7		
	4	1	9.1	10	90.9		
Q11	1	21	35	39	65	9.330	**0.025***
	2	55	40.4	81	59.6		
	3	7	16.7	35	83.3		
	4	1	14.3	6	85.7		
Q12	1	32	40.5	47	59.5	10.273	**0.016***
	2	45	37.8	74	62.2		
	3	6	17.6	28	82.4		
	4	1	7.7	12	92.3		
Q13	1	20	30.8	45	69.2	6.058	0.109
	2	58	19.2	90	40.8		
	3	5	23.8	16	76.2		
	4	7	10.1	5	20.4		
Q14	1	15	34.8	35	22.2	6.375	0.005*
	2	16	37.2	41	26.1		
	3	3	6.97	14	8.91		
	4	19	44.1	67	42.6		
Q15	1	12	27.9	52	33.1	7.478	0.074
	2	24	55.8	59	37.5		
	3	13	30.2	23	14.5		
	4	4	9.3	19	12.1		

P≤0.05 is statistically significant

Distribution and comparison of responses based on year of the study

Based on Year Of Study

- 64.78% of 4th BDS students have given the correct answer as application of nanoscale robots to diagnose, prevent and treat dental conditions followed by 23.5% of 3rd BDS followed by 11.8% of inters.

- 42.9% of 4th BDS students have given the correct answers as consent for the use of nanotechnology ins patient case followed by 32.8% 3rd BDS followed by interns.
- 3.22% of inters have given correct answers as in the next 10-15 years followed by 4th BDS 21.4% followed by 20.7% of 3rd BDS

	Response	III BDS		IV BDS		INTERN		Chi-Value	P-Value
		n	%	n	%	n	%		
Q1	1	56	28.3	74	37.4	68	34.3	14.101	**0.029***
	2	4	23.5	11	64.7	2	11.8		
	3	4	26.7	7	46.7	4	26.7		
	4	8	53.3	7	46.7	0	0		
Q2	1	22	17.3	53	41.7	52	40.9	28.850	**0.001***
	2	37	43.5	34	40	14	16.5		
	3	7	30.4	8	34.8	8	34.8		
	4	6	60	4	40	0	0		
Q3	1	14	15.4	35	38.5	42	46.2	25.294	**0.002***
	2	47	36.7	51	39.8	30	23.4		
	3	7	43.8	7	43.8	2	12.5		
	4	4	40	6	60	0	0		
Q4	1	17	18.9	27	30	46	51.1	34.158	**0.003***
	2	40	33.3	57	47.5	23	19.2		
	3	7	33.3	9	42.9	5	23.8		
	4	8	57.1	6	42.9	0	0		
Q5	1	14	20	22	31.4	34	48.6	20.383	**0.02***
	2	41	31.8	56	43.4	32	24.8		
	3	10	30.3	15	45.5	8	24.2		
	4	7	53.8	6	46.2	0	0		
Q6	1	16	22.5	21	29.6	34	47.9	16.967	**0.009***
	2	39	30	60	46.2	31	23.8		
	3	12	36.4	13	39.4	8	24.2		
	4	5	45.5	5	45.5	1	9.1		
Q7	1	19	23.5	23	28.4	39	48.1	22.851	**0.001***
	2	40	29.9	64	47.8	30	22.4		
	3	8	36.4	10	45.5	4	18.2		
	4	5	62.5	2	25	1	12.5		
Q8	1	12	17.4	21	30.4	36	52.2	25.779	**0.001***
	2	49	32.9	65	43.6	35	23.5		
	3	6	33.3	9	50	3	16.7		
	4	5	55.6	4	44.4	0	0		
Q9	1	18	26.1	19	27.5	32	46.4	16.601	0.11
	2	40	28.6	66	47.1	34	24.3		
	3	10	35.7	10	35.7	8	28.6		
	4	4	50	4	50	0	0		
Q10	1	15	22.1	19	27.9	34	50	25.253	**0.00***
	2	44	31.9	59	42.8	35	25.4		
	3	7	25	18	64.3	3	10.7		
	4	6	54.5	3	27.3	2	18.2		
Q11	1	11	18.3	18	30	31	51.7	26.188	**0.001***
	2	39	28.7	65	47.8	32	23.5		
	3	17	40.5	14	33.3	11	26.2		
	4	5	71.4	2	28.6	0	0		
Q12	1	16	20.3	32	40.5	31	39.2	10.763	0.096
	2	39	32.8	51	42.9	29	24.4		

	3	10	29.4	12	35.3	12	35.3		
	4	7	53.8	4	30.8	2	15.4		
Q13	1	15	23.1	18	27.7	32	49.2	20.107	**0.003***
	2	47	31.8	63	42.6	38	25.7		
	3	5	13.8	12	37.1	4	19		
	4	7	10.8	6	20.1	4	22.1		
Q14	1	12	22.6	16	22.8	18	23.3	17.458	**0.006***
	2	11	20.7	15	21.4	17	22.0		
	3	10	18.8	15	21.5	16	20.7		
	4	20	37.7	24	34.2	26	33.7		
Q15	1	4	7.54	9	12.8	10	12.9	21.537	**0.007***
	2	23	43.3	27	38.5	29	37.6		
	3	20	37.7	24	34.2	26	33.7		
	4	6	11.3	10	14.2	12	15.5		

P≤0.05 is statistically significant

DISCUSSIONS

The findings of this study highlight the growing awareness and mixed perceptions among healthcare students regarding the role of technology in their professional lives. Similar to how emerging technologies like nano robotic dentistry promise to revolutionize clinical practice by enhancing precision and patient care, students' engagement with digital platforms such as social media also reflects evolving professional behaviors and challenges. The use of a structured questionnaire allowed for the assessment of knowledge, attitudes, and practices, revealing areas where education and training can be improved to align with ethical and professional standards in the digital age. The pilot testing ensured the reliability of the instrument, though the convenience sampling limits the generalizability of the results. Future research should explore broader, multi-center studies to capture diverse perspectives and investigate how new technologies, both clinical and communicative, influence healthcare delivery and professionalism. Addressing these factors is critical as the integration of advanced technologies like nanorobotics and digital media reshape the landscape of healthcare education and practice.

CONCLUSION

Majority of dental students have a moderate knowledge of the emerging field of nanotechnology and robotic dentistry, which needs to be enhanced through awareness programs conducted via conferences, conventions, and social media platforms. As nano robotic dentistry holds immense potential to revolutionize dental care by enabling minimally invasive, precise, and personalized treatments, it is essential to integrate comprehensive education on this technology into dental curricula. Increasing students' familiarity and competence with nano robotic applications will prepare future dental professionals to adopt and advocate for these innovations in clinical practice. Moreover, continuous research, interdisciplinary collaboration, and ethical considerations must accompany technological advancements to ensure safe and effective implementation. Ultimately, fostering knowledge and acceptance of nano robotic dentistry will accelerate its transformation from fiction into practical reality, benefiting both practitioners and patients alike.

REFERENCES

1. Babel S, Mathur S. Nanorobotics: Headway towards dentistry. In J Res Sci Technology 2011; 1:1-9.
2. Bavani T. The application in dentistrynanocomposite. J Bioelectron Nanotechnol 2016; 1:4.
3. Cavalcanti A. Manufacturing technology for medical Nano robots. In Asia Pac Nanotechnol Forum News J 2007; 6:8-13.
4. Sujatha V, Suresh M, Mahalaxmi S. Nanorobotics-A futuristic approach. SRM Univ J Dent Sci 2010; 1:86-90.
5. Nimbulkar G, Multani P, Balsara K, et al. Nanotechnology in periodontal regeneration: A Review. Indian Journal of Forensic Medicine and Toxicology. 2020;14(4): 6796-6801