

Original article

Knowledge and attitude towards nanotechnology and intention to use nanomaterials: a cross-sectional study among dental students

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ABSTRACT

Background: Nanotechnology has the potential to actuate the world forward in a variety of ways. The advent of cutting-edge nanotechnology in medicine and dentistry may necessitate a need for university curriculum modification. The purpose of this study was to analyse dentistry students knowledge about nanotechnology and their attitude towards it.

Aim: To assess the knowledge and attitude of dental students towards nanotechnology and intention to use nanomaterials.

Methods: A cross-sectional study was conducted among the dental students(III year, IV year, interns ,postgraduates) in a tertiary care teaching hospital, khammam. Using a web-based tool called google forms, a semi-structured online questionnaire was designed and distributed via link to the students in order to fill. Descriptive statistics and chi-square tests were calculated using SPSS version 23. A p-value <0.05 was used to evaluate statistical significance.

Observations & Results: A total of 270 dental students participated in the survey. Age of participants ranges from 20 to 26 years. Majority of the students(49.63%) had reported that they were unfamiliar (or) with little knowledge about nanotechnology. About 81.85% students expressed an interest in learning more about nanotechnology. The attitude towards the use of dental nanoparticles had the greatest impact on the intention to employ nanomaterials(by 70.37%).

Conclusion: Students displayed a lack of understanding about nanotechnology. Attitudes influenced the decision to employ nanomaterials the most. The respondents revealed a clear demand for greater understanding concerning the application of nanotechnology in dentistry, indicating a need for curriculum change.

Key words: Knowledge, attitude, nanotechnology, dental students.

INTRODUCTION

Nanotechnology is a comprehensive field of science and technological inventions. It is operated on the “nano scale”-i.e, one billionth of a metre, which is ten times the diameter of a hydrogen atom. It is defined as “the manipulation of matter of sized less than 100 nm. At nanoscale, the results of manipulation of matter seems to be in unexpected ways, leading to enduring inventions. Nanotechnology has been embraced in almost all the fields of medicine ,ranging from diagnosis to treatment procedures. In spite of many significant benefits towards medicine and dentistry, some questions still remain, regarding its limitations and environmental risks.

Several studies have been carried out regarding knowledge and insight of nanotechnology among the population in different countries. Firstly, the population has been divided into general category and an expert category. Secondly, following surveys in two categories, the result from general category revealed their unfamiliarity

towards nanotechnology. In addition to this, the general category seemed to have a positive attitude towards nanotechnology. Lastly, expert category have responded that nanotechnology would cope up with increased benefits and with lower possible risks and *limits*^{1,2}.

Nanotechnology has been widely used in various applications of dentistry. Nanoparticles like gold, carbon, zinc oxide, silver, have been used in the manufacture of various dental materials such as adhesives, impression and endodontic materials, resin composites, dental *implants*^{3,4}. In spite of rapid advances, it is still a question-“will nanotechnology will be the future scope for the evolving diseases”?

Another study, which was investigated based on gender revealed that men were more likely to support nanotechnology than women. In addition, highly educated people are more fascinated towards nanotechnology in contrary to lower ones.

In the recent era of pandemic, the applications of nanotechnology (in the form of biosensors drug delivery agents etc) could help in combatting the adverse effects of Severe Acute Respiratory Syndrome (SARS-CoV-2). So it is necessary to make people acquainted regarding the nanotechnology.

As nanotechnology is a rapidly developing field, and its applications are included in various aspects resulting in ensuring an improved version of life. In particular, nanotechnology in dentistry will switch the usage of conventional dental materials with nanomaterials. So, the ultimate goal of this study is to transfer its knowledge to the dental students and for achieving better results.

AIM: To assess the knowledge and attitude of dental student towards the nanotechnology and intention to use nano materials.

OBJECTIVES:

1. To determine the knowledge and attitude of dental students about the nanotechnology and its applications in dentistry based on gender and year of study
2. To determine the practice of dental students about the nanotechnology and its future scope in dentistry.

METHODOLOGY

Study design and participants:

This cross-sectional study was conducted over a period of 10 days, at tertiary care teaching hospital, Khammam, Telangana. The study population comprised of 270 dental students, which included, III year (n=93), IV year (n=94), interns (n=71), PG's (n=12).

Data collection and analysis:

A 20-question semi-structured online questionnaire was prepared using a web-based application called Google Forms and distributed to students via link provided by a social media website. Participants were asked to select one option from the answers provided against each question. Ethical clearance was obtained from ethical committee of Mamata Educational Society, Khammam, Telangana to conduct the study.

Data from the filled questionnaires was tabulated in Excel worksheets and statistical analysis was performed using SPSS version 23. The level of significance was set as <0.05.

RESULTS

Out of 270 participants, majority of them belonged to 22-23 years age group, with a mean age of 24±2.58 years. The following are the percentages of students who took part in the survey: III BDS (34.4%), IV BDS (34.81%), INTERNS (26.30%), PG (4.44%). The response rates were 80.37% females and 19.63% males. Table 1 depicts the percentage distribution of students by their demographic characteristics.

On comparison of knowledge and attitude of dental students towards nanotechnology across gender and year of study(table 2 & 3), it justifies their positive attitude towards the applications of nanotechnology. 48.15% of the students supported to include “nanodentistry” as a subject. In light of the overall result, the majority of respondents agreed that nanotechnology could be one of the technologies that has the potential to change the scope of dentistry.

Table 1: Demographic profile of respondents:

Demographic profile	No of students	% of students
Age in years		
20-21yrs	91	33.70
22-23yrs	140	51.85
>=24yrs	39	14.44
Gender		
Male	53	19.63
Female	217	80.37
Years of study		
III BDS	93	34.44
IV BDS	94	34.81
Interns	71	26.30
PG	12	4.44
Total	270	100.00

Table 2: Comparison of knowledge of dental student towards nanotechnology across gender and year of study

	GENDER		p-value	YEAR OF STUDY				p-value
	Males	Females		III BDS	IV BDS	Interns	Postgraduates	
Nanoparticles are being used in?								
Tooth pastes	4 (7.55%)	9 (4.15%)	0.6950	5 (5.38%)	7 (7.41%)	1 (1.41%)	0 (0.00%)	0.3310
Resin composites	6 (11.32%)	20 (9.22%)		11 (11.83%)	11 (11.70%)	4 (5.63%)	0 (0.00%)	
Impression and endodontic materials	4 (7.55%)	15 (6.91%)		8 (8.60%)	7 (7.45%)	4 (5.63%)	0 (0.00%)	
All the above	39 (73.58%)	173 (79.72%)		69 (74.19%)	69 (73.40%)	62 (87.32%)	12 (100%)	

Table 3: Comparison of attitude of dental students towards nanotechnology across gender and year of study

	GENDER		p-value	YEAR OF STUDY				p-value
	Males	Females		III BDS	IV BDS	INTERNS	PG	
Do you consider inclusion of “nanodentistry” as a subject?								
Yes	27 (50.94%)	103 (47.47%)	0.3220	41 (44.09%)	38 (40.43%)	44 (61.97%)	7 (58.33%)	0.1240
No	7 (13.21%)	17 (7.83%)		11 (11.83%)	9 (9.57%)	3 (4.23%)	1 (8.33%)	
May be	19 (35.85%)	97 (44.70%)		41 (44.09%)	47 (50.00%)	24 (33.80%)	4 (33.33%)	

Table 4: percentage distribution of students by knowledge and attitude towards nanotechnology:

Have you studied nanomaterials in your dental course?		
Yes	147	54.44
No	123	45.56
How much information you have received from your lectures regarding nanotechnology?		
No	79	29.26
Little	134	49.63
Moderate	50	18.52
Adequate	7	2.59
In which year, the government has launched a 5 year program called "NANO MISSION" with wider objectives and larger funding of USD 250 million.		
2005	73	27.04
2007	105	38.89
2009	63	23.33
2011	29	10.74
Nanoparticles are being used in?		
Tooth pastes	13	4.81
Resin composites	26	9.63
Impression and endodontic materials	19	7.04
All the above	212	78.52
Nano materials enables improved diagnosis, treatment and monitoring of many serious illnesses including		
Cancers	35	12.96
Cardiovascular and neurological disorders	14	5.19
Diabetes	7	2.59

All the above	214	79.26
Which of the following can be used as nanoparticles ?		
Silver	18	6.67
Carbon	23	8.52
Gold	14	5.19
Zinc oxide	13	4.81
All the above	202	74.81
Are you familiar with the term "nanorobots"?		
Yes	125	46.30
No	145	53.70
If yes, applications of nanorobots may include in:		
Inducing anesthesia	12	9.60
Hypersensitive cure	9	7.20
Oral hygiene & Halitosis	9	7.20
Orthodontic corrections	5	4.00
All the above	62	49.60
Don't know	28	22.40
Do you want to get more information about the application of nanotechnology in dentistry in the dental curriculum?		
Yes	221	81.85
No	49	18.15
Do you think, nanotechnology could pose any risks and limits?		
Economy	23	8.52
Information loss	11	4.07
Nanoparticle toxicity	47	17.41

All the above	136	50.37
None	53	19.63
May be	156	57.78
What would you rate about the scope of nanotechnology will improve the oral health and quality of life for countless people and communities in the future?		
30	46	17.04
50	93	34.44
70	95	35.19
90	36	13.33
Do you support/encourage to use nanomaterials in your future dental practice?		
Strongly disagree	22	8.15
Disagree	31	11.48
Agree	190	70.37
Strongly agree	27	10.00
How easy (or) difficult do you think it will be for you to apply nanomaterials in your future dental practice?		
Very difficult	21	7.78
Difficult	112	41.48
Easy	120	44.44
Very easy	17	6.30
Do you consider inclusion of "nanodentistry" as a subject?		
Yes	130	48.15
No	24	8.89
Maybe	116	42.96

DISCUSSION

In the past, various studies had been carried out on experts as well as laypersons, in order to ensure their knowledge and perception towards *nanotechnology*^{5,6}, which stated that 44.2% were reported to have little knowledge about nanotechnology. In this survey, majority of the students (82.22%) were aware of the term nanotechnology and 46.67% were conscious about what does it mean and lastly, 49.63% were with little information from their lectures regarding nanotechnology. Comparatively, 38.89% from the total sample were aware of its objectives launched by the government.

Most of the respondents were aware that nanoparticles are being used in toothpastes, resin composites, impression and endodontic materials (78.52%). Its applications enables improved diagnosis, treatment and monitoring of many serious illnesses including cancers, cardiovascular and neurological disorders, diabetes was positively responded by 79.26%. In addition to this, about three-fourth of the students(74.81%), were aware of nanoparticles being used, like silver, carbon, gold, and zinc oxide (table 4).

As the subject of nanotechnology has yet to be fully resolved, introducing information on nanotechnology to students may be a difficult *task*^{7,8}. In view of such contentious topic that can lead to misunderstandings, more attention should be made to the manner in which educational materials are presented, so that students may have a better knowledge of the benefits and risks associated with *nanotechnology*^{9,10}.

Most of the respondents (70.37%) supported to use nanomaterials in their future dental practice and 44.44% of the sample admitted that it could be easy to apply the nanomaterials in future dental practice. Besides, out of 100% of the sample, 48.15% considered inclusion of nanotechnology as a subject. Another remarkable segment of nanotechnology is nanorobots. Of which, 53.70% of the sample were oblivious by this term. 50.37% admitted that it could possess economy, information loss and nanoparticle toxicity like environmental risks and limits(table 4).

Notably, when giving information regarding nanomaterials, caution should be exercised so that students intents to utilise them are based on reputable sources and scientific data.

CONCLUSION

The current findings imply that dental students in khammam have a limited understanding of nanotechnology. During their academic studies, pupils exhibited an interest in learning more about nanotechnology. As a result, there appears to be a need for curriculum revisions that address the application of this cutting-edge technology in dentistry.

REFERENCES

1. Ho SS, Scheufele DA, Corley EA. Value predispositions, mass media, and attitudes toward nanotechnology: the interplay of public and experts. *Sci Commun.* 2011;33(2):167-200.
2. Siegrist M, Keller C, Kastenholz H, Frey S, Wiek A. Laypeople's and experts' perception of nanotechnology hazards. *Risk Anal.* 2007
3. Mitra SB, Wu D, Holmes BN. An application of nanotechnology in advanced dental materials. *J Am Dent Assoc.* 2003;134(10):1382-1390.
4. Subramani K, Ahmed W. *Emerging Nanotechnologies in Dentistry: Processes, Materials and Applications.* Oxford, UK: Elsevier; 2011: 15-80. ;27(1):59-69.

5. Retzbach A, Marschall J, Rahnke M, Otto L, Maier M. Public understanding of science and the perception of nanotechnology: the roles of interest in science, methodological knowledge, epistemological beliefs, and beliefs about science. *J Nanopart Res.* 2011;13(12):6231-6244.
6. Vandermoere F, Blanchemanche S, Bieberstein A, Murette S, Roosen J. The morality of attitudes toward nanotechnology: about God, techno-scientific progress, and interfering with nature. *J Nanopart Res.* 2010;12(2):373-381.
7. Bainbridge WS. Public attitudes toward nanotechnology. *J Nanopart Res.* 2002;4(6):561- 570.
8. Besley JC, Kramer VL, Priest SH. Expert opinion on nanotechnology: risks, benefits, and regulation. *J Nanopart Res.* 2008;10(4):549-558.
9. Pidgeon N, Harthorn BH, Bryant K, Rogers-Hayden T. Deliberating the risks of nanotechnologies for energy and health applications in the United States and United Kingdom. *Nat Nanotechnol.* 2009;4(2):95-98.
10. Service RF. Nanotechnology - calls rise for more research on toxicology of nanomaterials. *Science.* 2005;310(5754):1609.

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