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Knowledge and Attitude of UG Dental Students about Nanotechnology in Dentistry

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ABSTRACT

The term nano is derived from a Greek word 'nannos' which means dwarf. Nanotechnology is the science that deals with physical, chemical and biological properties of structures at the nanoscale. Nanotechnology is used in science, biotechnology, computer technology, electronics, agriculture, household as well as dentistry. Nanotechnology was used in dentistry in the early 1970s in microfilled composites comprising particles less than 100nm diameter. In recent times the composite particles are used that range from 20-600nm. In dentistry it is mainly used in restoration, orthodontic treatment and injecting local anesthesia and has many other uses. The main aim of nanotechnology in dentistry is to prevent any oral disease rather than treating it. The aim of the study is to evaluate the knowledge and attitude of UG dental students about nanotechnology in dentistry. A cross-sectional prospective survey was created in google docs with a questionnaire containing 15 questions, and the link was shared to 100 UG dental students. The results were analysed and represented as a pie chart and bar diagrams. Majority of (60%) of them were aware about nanotechnology, and few were not aware (40%). 46% of students were aware of the use of nanotechnology in dentistry, and 52% of participants felt it nanomaterials was not affordable. From the results obtained, the knowledge and attitude among Undergraduate dental students about nanotechnology in dentistry was found to be average.

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INTRODUCTION

Nano refers to dwarf, which is derived from a Greek word 'nanoos' the term nanotechnology was first established by Richard Feynman in the year 1959 (Neelakantan, 2014). It refers to the science and technology of using particles of nano size (1-100nm) (Das and Nasim, 2017). In many fields of science such as physics, chemistry, biology and medicine, people are involved in the research. Nanoparticles are used in cosmetics, textile, information technology and so on (Shapira *et al.*, 2010). Apart from these nanotechnologies is also used in dentistry. Oral health can be maintained by the use

of nanotechnology. There are many advancements taking place in dentistry likewise it has shifted from macro to nano in dental sciences. It is important to focus on minute details in materials. The classic restoration methods can be replaced by sensitive and precise methods. Research in nanotechnology in dentistry allows the use of dental materials and tools of the same. Nanotechnology has been improved in dentistry by the use of nanotools of ultrafine structures to help in exploring dental structures of tissues.

Nanotechnology was used in dentistry in the early 1970s in micro filled composites comprising particles less than 100nm diameter. In recent times the composite particles are used that range from 20-600nm. Biomimetics is a nanotechnology mimicking process that occurs in nano restoration (Uskoković and Bertassoni, 2010). Nanotechnology in dentistry is mainly used as composites and bonding agents. It is used in diagnosis and surgical procedures using nano needles and nano-hydroxyapatite needles.

In composite resin nano impression and nano aluminium oxide are used. Apart from this anesthesia is given using nanorobots These nanorobots are placed in the gingiva that enters the pulp within 100 seconds under the control of a nanocomputer. Nano robotic anesthesia helps to reduce anxiety and pain Dentifro robots supplied by dentifrice are found to be bactericidal. These are capable of deactivating themselves if they are swallowed by mistake. These are also used in toothpaste toothbrushes and floss. Orthodontic nanorobots help in straightening the teeth without any pain in a single visit to the dentist.

Nanotechnology used in composites reduces polymerisation and shrinkage, prevents caries, improves wear resistance and improves biocompatibility (Suresh *et al.*, 2014). The main aim of nanotechnology in dentistry is to prevent any oral disease rather than treating it (Faden *et al.*, 2019). Nanotechnology is used in dental implants, the surface of implants have nanopores, so these pores are filled with nanoparticles for interaction with tissues. (Salerno and Diaspro, 2015). Nano diagnostic devices are used for early diagnosis at the cellular and molecular levels.nano devices are used for collecting tissue samples, and fluids can be inserted into the body to detect the disease Nano solution in the form of nano oil droplets are used as a sterilizing solution (Solanke *et al.*, 2014). Nanotechnology is also used in dentin hypersensitivity and tooth renaturation (Mehta *et al.*, 2008).

Over the past years various research done by our team was on Osteology (Choudhari and Thenmozhi, 2016), foramens in middle cranial fossa (Hafeez and Thenmozhi, 2016), styloid process (Kannan and Thenmozhi, 2016), foramen of Huschke (Keerthana and Thenmozhi, 2016), foramen meningo-orbitale (Pratha and Thenmozhi, 2016), girdy's tubercle (Nandhini *et al.*, 2018), Occipital emissary formanen (Subashri and Thenmozhi, 2016), stature estimation, (Krishna and Babu, 2016), radiation effects of mobile phone (Sriram *et al.*, 2015), use of i-pads in education (Thejeswar and Thenmozhi, 2015), on micro RNA (Johnson *et al.*, 2020; Sekar *et al.*, 2019), animal studies (Seppan *et al.*, 2018) and in few other fields like thyroid function (Menon and Thenmozhi, 2016) and amblyopia (Samuel and Thenmozhi, 2015).

There is a lack of information on the current topic of awareness of nanotechnology in dentistry, so the aim of the study is to evaluate and assess the knowledge and attitude of Undergraduate dental students about nanotechnology in dentistry.

MATERIALS AND METHODS

A cross-sectional study was done using google docs. A self-structured questionnaire containing 15 questions were prepared and approved by SRB of Saveetha Dental College and Hospitals. The link was shared to 100 Undergraduate dental students, and the results were analysed using SPSS statistics 19 and represented in the form of a pie chart using descriptive statistics. Minimizing errors, framing questions in simple language and avoiding leading questions were some of the measures taken to minimize bias. The advantage of the study is that it was economical, easy to do and quickly interpreted. The disadvantages were homogeneous population, survey fatigue and response bias.

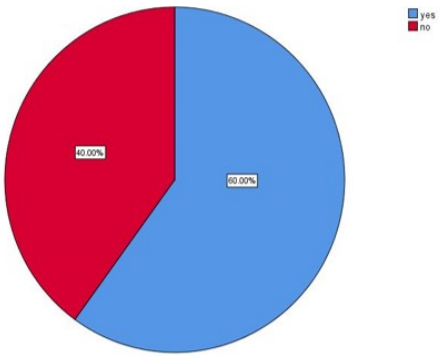

Figure 1: Awareness about nanotechnology 60% of the students were aware about nanotechnology whereas 40% were not aware

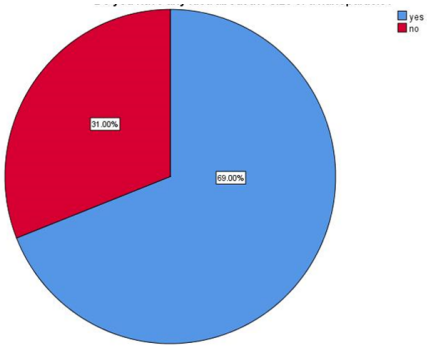

Figure 2: Awareness regarding the size of a nanoparticle

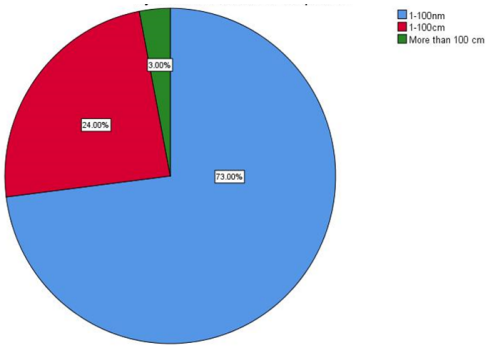

Figure 3: Awareness about the size of nanoparticles is the majority of them

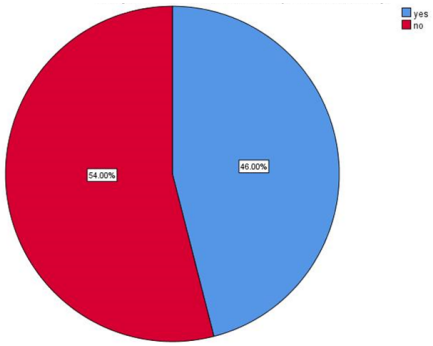

Figure 4: Awareness about the use of nanoparticles in dentistry

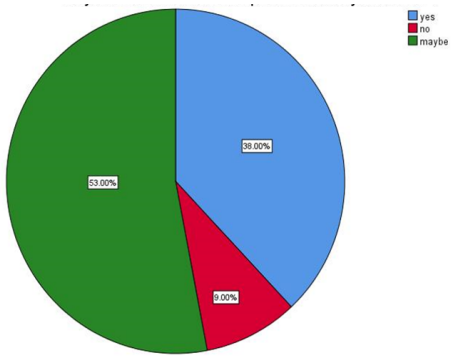

Figure 5: Awareness regarding the beneficiality of nanotechnology

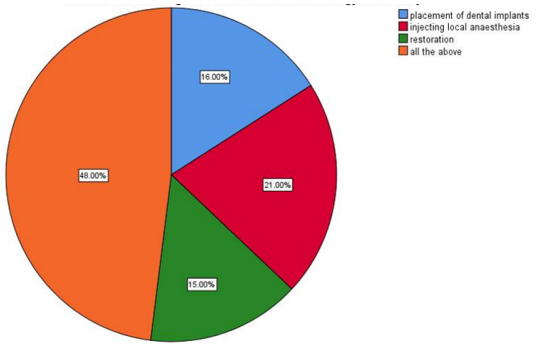

Figure 6: Awareness regarding the uses of nanotechnology

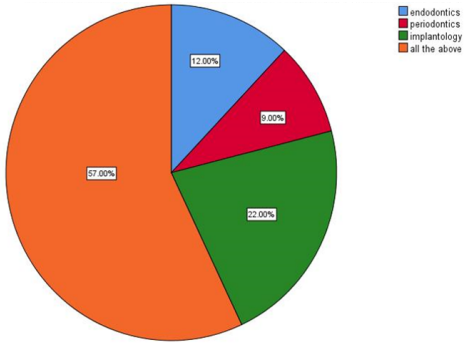

Figure 7: Knowledge about the use of nanotechnology

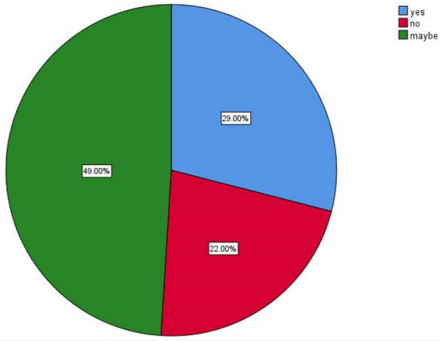

Figure 8: Awareness about the nature of nanomaterials

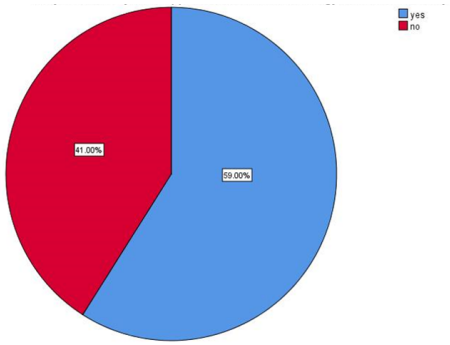

Figure 9: Awareness regarding the application of nanotechnology

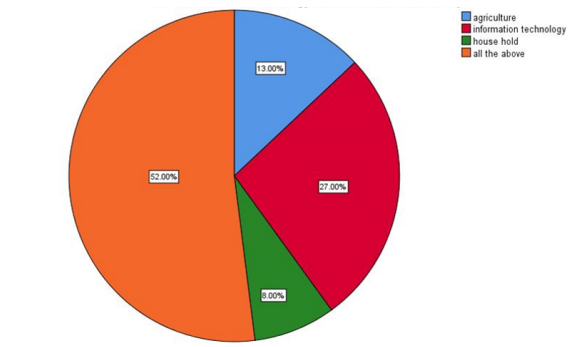

Figure 10: Awareness about the uses of nanotechnology

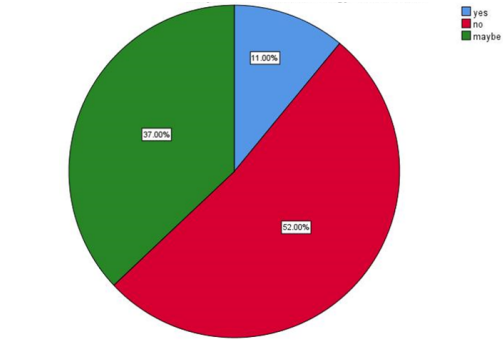

Figure 11: Knowledge about the affordability of nanotechnology

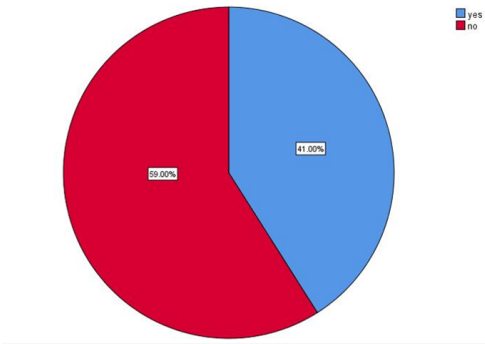

Figure 12: Awareness about the term nanorobots

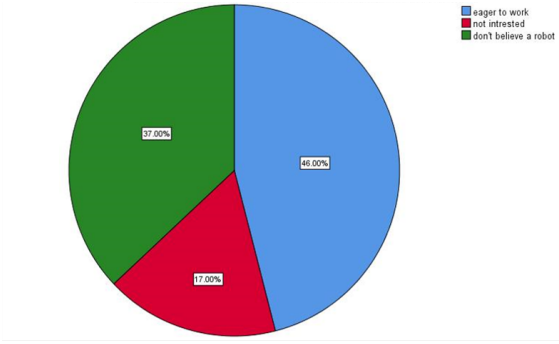

Figure 13: Attitude about using nanorobots in future dentistry

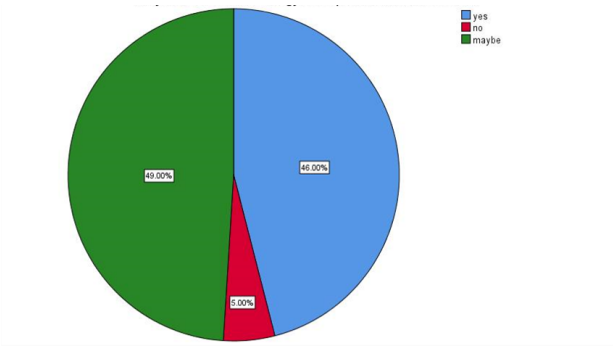

Figure 14: Perception about nanotechnology in future dentistry

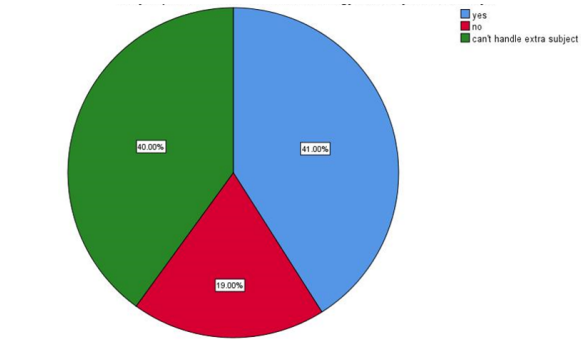

Figure 15: Attitude regarding the inclusion of nanotechnology

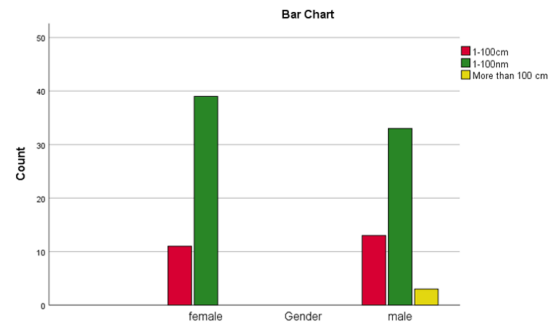

Figure 16: Bargraph representing chi-square analysis.

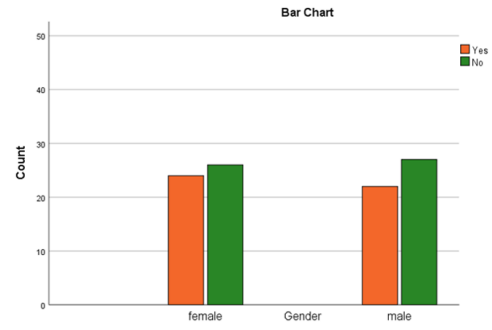

Figure 17: Bargraph representing chi-square analysis

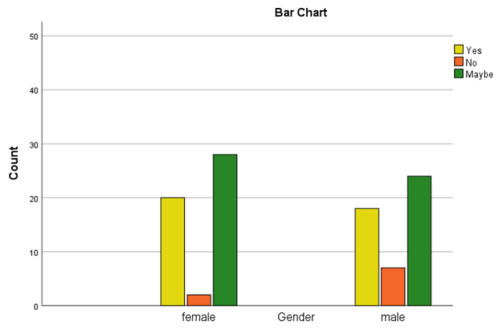

Figure 18: Bargraph representing chi-square analysis

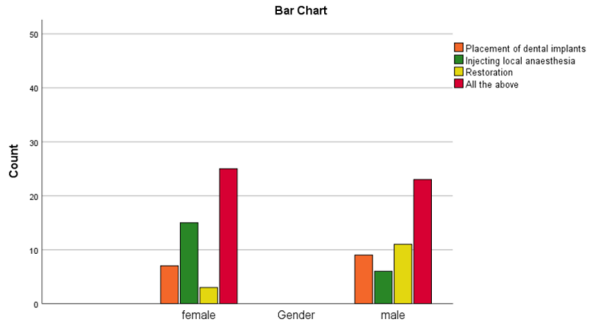

Figure 19: Bar graph representing chi-square analysis

RESULTS AND DISCUSSION

From the results obtained In Figure 1, out of 100 participants, 60% were aware of nanotechnology, and 40% were not aware of nanotechnology.

Figure 2, 69% of the students had an idea about the size of a nanoparticle whereas 31% were not aware about the size of nanoparticle. In Figure 2, 69% were aware about the size of the nanoparticle whereas 31% lack awareness about the size of nanoparticle in Figure 3 , 73% of them have answered that 1-100mm is the size of the nanoparticle, 24% have answered that size of the nanoparticle is (1-100cm), and 3% have answered the size of the nanoparticle is more than 100. 73% answered correctly about the size of a nanoparticle, while the remaining 27% answered incorrectly.

Figure 4, shows that 46% of the participants were aware of the use of nanoparticles in dentistry and 54% of them lack awareness about nanoparticles in dentistry.

Figure 5, show that 53% of the participants think that the use of nanoparticles in Dentistry may be beneficial and 9% feel that nanoparticles in dentistry is not beneficial. 53% answered that use of nanoparticles were beneficial in dentistry, 38% answered that it maybe beneficial and the remaining 9% felt that nanotechnology was not beneficial

In Figure 6, 16% of them feel that nanotechnology is used in placing implants, 21% feel that it is used in injecting local anaesthesia, 15% feel that it is used in restoration and the majority of them about 48% have answered that nanotechnology is used in all the above mentioned options. X-axis represents gender, and the Y-axis represents the number of students aware about the size of nanoparticles. Pearson's Chi value = 291.282, df=12, P-value was 0.001 (<0.05) hence statistically significant. In dentistry 48% answered all the above are the uses of nanotechnology in dentistry, whereas 16% knew only about implant placement, 21%knew only about local anaesthesia, and 15% knew about restorations.

In the Figure 7, 12% of the participants think that nanotechnology is used in endodontics, 9% feel that it is used in periodontics, 22% feel that it is used in implantology and the remaining 57% participants have responded that nanotechnology is used in all the above mentioned departments in dentistry. In branches of dentistry 57% of the students responded that nanotechnology is used in all the above branches of dentistry.

In Figure 8, 29% have answered nano materials hazardous 22% have answered it is not hazardous, and the majority, 49% have answered it could be hazardous. 49% of the students felt nanotechnology might be hazardous, whereas 29% felt nanotechnology was hazardous. 22% felt nanotechnology was not harmful.

In Figure 9, 59% of them were aware about the application of nanotechnology other than dentistry, and 41% of them were not aware. In dentistry 59% were aware of the uses of nanotechnology other than dentistry, whereas 41% of students were not aware.

In Figure 10, 13% of the participants have answered that other than dentistry nanotechnology is used in agriculture, 27% have responded that it is used in information technology, 8% have answered that it is used in household and the remaining participants feel that nanotechnology is used in all the above mentioned options other than dentistry. In other fields 52% answered all the above are the uses of nanotechnology other than dentistry.

In Figure 11, 11% have answered that nanotechnology is affordable 37% have answered maybe it affordable, and 52% have answered nanotechnology is not affordable, 52% of the students felt that nanotechnology was not affordable, while 37% felt it

might be affordable. Remaining 11% felt nanotechnology was affordable.

In the Figure 12, 41% of them were aware about nanorobots and the remaining 59% lack awareness about nanorobots, 59% of the students were not aware of nanorobots, whereas the remaining 41% of students were aware of nanorobots. In Figure 13, 46% of them were eager to work with nanorobots, and 7% of the participants were not interested in working with nanorobots. 46% of the students were eager to work with nanorobots in dentistry, whereas 37% did not believe in nanorobots.17% were not interested in nanorobots

In the Figure 14, 46% think that nanotechnology will improve future dentistry, 5% feel that it will not improve future dentistry, and 49% feel that nanotechnology might improve dentistry in future. 49% of the students felt that nanotechnology will improve treatment in future, 46% said it may improve the treatment in the future, whereas 5% answered no.

In Figure 15, 41% have answered that they prefer the inclusion of nanotechnology as a subject identity, 19% have answered no, and 40% have responded that they can't handle an extra subject. Subject 41 % of the students prefered the inclusion of nanotechnology as a subject, 19% did not want nanotechnology as a new subject, whereas 41% could not handle a new subject. The Figure 16 representing the association between gender and awareness about the size of the nanoparticles P-value was 0.001(<0.05), and it was statistically significant.

The Figure 17 represents the association between gender and use of nanoparticles in dentistry. P-value was 0.001(<0.05). The X-axis represents gender, and the Y-axis represents the number of students who were aware about the use of nanoparticles in dentistry. Pearson's Chi value = 286.138, df=9, P-value was 0.001 (<0.05) hence statistically significant.

The Figure 18 represents the association between gender and awareness about the beneficiality of nanoparticles in dentistry. X-axis represents gender, and Y-axis represents the number of students who were aware about beneficiality of nanoparticles in dentistry. Pearson's Chi value = 290.595, df=12,P-value was 0.001 (<0.05) and it was statistically significant.

P value was 0.001 (<0.05), and it was statistically significant. The Figure 19 showing association between gender and uses of nanotechnology in dentistry, the P-value was 0.001(<0.05), and it was statistically significant. X-axis represents gender, and the Y-axis represents the number of students who were aware about the uses of nanotechnology in dentistry. Pearson's Chi value = 298.643,P value was 0.001(<0.05) and it was statistically significant.

A similar study was conducted by (Faden *et al.*, 2019) where 10.4% of them have said nanotechnology is expensive and hazardous, 28% have answered that is cheap and beneficial, and 86.9% have answered nanotechnology is expensive and beneficial similarly in the study conducted by (Ali *et al.*, 2017) regarding the awareness about nanotechnology 56.8% answered "yes", 29.5% answered "no" and 13.6% have answered maybe. Regarding the size of the nanoparticle, 66.7% have answered that they were "yes" aware, 16.7% "no" and 14.3% "maybe". About the inclusion of nanotechnology in dentistry as a subject, 87.8% have said "yes", 9.8% "no" and 2.5% "maybe". 59.5% have answered that nanoparticles are hazardous, 26.2% have said "no", and 14.3% answered "maybe" in another study conducted by (Rahimpour *et al.*, 2012) 32% have answered that nanotechnology is used in the industry.

CONCLUSION

Nanotechnology has taken a step forward, leading to many advancements in dentistry. So this study helped in the evaluation of knowledge and attitude of Undergraduate dental students about nanotechnology in dentistry by concluding that the students have average knowledge about nanotechnology and its uses in dentistry.

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Conflict of interest

The authors declare that they have no conflict of interest for this study.

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