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Knowledge of Academic Omfs in Regenerative Nanotechnology in Field of Oral and Maxillofacial Surgery: A Questionnaire Survey

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ABSTRACT

Aim: The purpose of this research was to assess the knowledge of regenerative nanotechnology in the field of oral and maxillofacial surgery.

Methodology: A survey was conducted amongst 42 oral surgeons with the help of a questionnaire which had 10 questions assessing their knowledge regarding the application of regenerative nanotechnology in their field and how it can be improved. Their responses were subjected to descriptive statistical analysis using SPSS 25.0.

Results: It was observed that the oral surgeons felt that there is need for more imparting of knowledge to budding practitioners (1.006, p=0.03), which was statistically significant. Around 69% of the participants felt that nanotechnology can be effectively used in cases of oral cancer for regeneration of the lost tissue (0.956, p=0.011).

Conclusion: It is imperative for implementing course related to nanotechnology in the curriculum of the post graduate studies which will help the future budding dental professionals to be confident about this emerging technology.

Keywords:nanotechnology, oral surgery, regenerative bone technology.

INTRODUCTION

The concept of nanotechnology was first introduced by the quantum theorist and Nobel laureate Richard Feynman in 1959.[1] An accepted definition of it is "research and technology development at the atomic, molecular, or macromolecular levels; in the scale of approximately 1 to 100 nanometer range; to provide a fundamental understanding of phenomena and materials at the nanoscale; and to create and use structures, devices, and systems, which have novel properties and functions because of their small and/or intermediate size."[2] The term "nanotechnology" did not make much impact on scientific publishing until Taniguchi coined it in 1974 to describe the ability of engineering materials at

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the nanoscale.[3] Because they are extremely small, nanoparticles have a high surface area: volume ratio that confers mechanical, magnetic, optical, and chemical properties that are superior to those of the original materials. The fundamental concepts behind, and the main driving force in, the advancement of nanotechnology, stemmed from the electronics industry. By the early 1970s the IBM Corpora-tion had created a method called "electron beam lithography" that could be used to manipulate structures as small as 40-70 nm.[4] With the rapid development of nanotechnology, nanomaterials such as nanoparticles, nanofibers, nanotubes, nanosheets, and others have been widely used in cranio-maxillofacial and dental tissue engineering even though nanomaterials application in tissue engineering still encounter enormous challenges. Among the nanomaterials used to reconstruct boneare: derivatives of polyhydroxyacids, such as polylactide(PLA), polyglycolide (PGA), poly(Ɛ-caprolactone) (PCL),and their copolymers poly(lactide-co-glycolide) (PLGA),poly(lactide-co-caprolactone) (PLC), poly(glycolide-cocaprolactone) (PGC), and poly(L-lactic acid) (PLLA),and these have been studied extensively.[5]These nanoparticles are uniformly dispersed within a matrix, which gradually biodegrades, releasing loaded drugs in increments to provide a longer contact duration with the diseased site.[6] Niosomes, for instance, are chemically stable non-ionic vesicles, which offer a controlled and targeted drug delivery with enhanced penetration through biological tissue especially when the particles are less than 100 nm in size.[7] Furthermore, fullerenes have been heavily studied for their many potential applications, one of which is its effectiveness in drug delivery. Fullerenes are hollow carbon molecules which come in different shapes (spheres, tubes, and ellipsoids). The buckminsterfullerene (C60) was the first and most stable fullerene discovered in the 1980s, which resembled the geodesic domes designed by Buckminster Fuller, hence, named after him.These fullerenes can be constructed by either a bottom up approach, building it atom by atom, or by a top down approach from lager atoms, which according to the literature proved to produce a more stable fullerene structure.[8] It was additionally used for other purposes in the medical field, such as radical scavenging and as antioxidants. The literature also reports the benefits of combining a light curable, methacrylate resin matrix, with nACP as a bone grafting agent. This injectable material has the ability to strongly adhere to wet bone, and in recrystallizing nACP to hydroxyapatite in a matter of minutes.[7]It has been theorised that the osseointegration of implants within the jaw bone would be maximised if the implant surface was mimicking the surface topography of the extracellular matrix within natural tissue, which is typically between 10 and 100 nm in size.[9] Published data proved this theory, as not only surface coatings such as hydroxyapatite, gold, silver, and titanium oxide nanoparticles have the ability to improve the adhesion of the fibrin clot which serves as a bridge for osteogenic cells and the overall osseointegration of implants, the presence of mechanical nano-features such as nano-grooves or nano pillars have been proved effective as well, with particular emphasis on the distribution and order of such features on the implant surface.[10,11]

AIM OF THE STUDY

The purpose of this research was to assess the knowledge of regenerative nanotechnology in the field of oral and maxillofacial surgery amongst oral surgeons.

METHODOLOGY

A questionnaire survey was conducted amongst 42 oral and maxillofacial surgeons with clinical experience of more than 3 years. The participants consisted of 15 female and rest were male participants. Binary format was chosen for the questionnaire and then formulated in English language. The questions were based on importance of regenerative nanotechnology in case of cases pertaining to various fields of oral and maxillofacial surgery, techniques as well as the process to improve the knowledge in order to accelerate the usage of

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this effective and novel technology. The questionnaire was sent to the email of the participants, and their responses were recorded on an excel worksheet and analysed with the help of descriptive statistical analysis – mean and standard deviation as well as frequency percentage. The data was evaluated with the help of SPSS 25.0.

RESULTS

Around 7 questions were asked to the respondents in the present study, where answers were given in either "yes" or "no". (Table 1) It was observed that the oral surgeons felt that there is need for more imparting of knowledge to budding practitioners (1.006, p=0.03), which was statistically significant. Around 69% of the participants felt that nanotechnology can be effectively used in cases of oral cancer for regeneration of the lost tissue (0.956, p=0.011). Only 23% of participants practiced nanotechnology in their routine clinical practice. (Table 2)

Table 1- Questionnaire of the study

Q. no.	Questions
1	Do u practice nanotechnology in your practice?
2	Are you aware of recent developments in regenerative nanotechnology?
3	Do you think nanomaterials are very technique sensitive?
4	Are you equipped with technology related to nanotechnology?
5	Being expensive is one of the Disadvantage of nanotechnology?
6	Are you satisfied with the current knowledge amongst various dental practioners as well as oral surgeons in particular?
7	Do you think nanotechnology can help in treatment and regeneration in cases of oral cancer?

Table 2- Data recorded in the present study

Q. no.	Response -yes	Response- no	mean±SD	P value
1	23%	77%	3.56	1.02
2	12%	88%	1.009	0.025
3	76%	24%	2.034	0.08
4	16%	84%	2.84	0.093
5	66%	34%	2.901	0.078
6	11%	89%	1.006	0.03
7	69%	31%	0.956	0.011

**p<=0.05 is significant*

DISCUSSION

The science and applications of nanotechnology are constantly evolving as we witness new products being introduced into the market. This comes with great responsibility to insure the safety, efficiency, and applicability of such new technologies. Their level of effectiveness as shown in the literature diverge, being more effective than some materials and less effective than others. Although nanomaterials generally offer superior aesthetics and polishability, their mechanical properties fall short in comparison to microfilled resin composites for example. Therefore, the choice to use nanomaterials is dependent on the clinical scenario and tooth to be restored, paying close attention to aesthetic demand, loading, and the presence of any risk factors such as parafunctional habits. Research to improve upon existing nanomaterials is still ongoing, with future directions towards more efficient and cost-effective nano-biosensing devices to diagnose in high accuracy oral cancer for example, in addition to

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new oral drug delivery systems to disrupt biofilm formation and reduce the incidence of caries and periodontal disease. Although the science behind nanotechnology is intriguing, the lack of long- term clinical evidence addressing their clinical performance restricts their wide clinical use.Regenerative nanotechnological uses in oral and maxillo-facial surgery are increasing rapidly, and there have been recent exciting breakthroughs. Although the realm of bio-materials for bone regeneration is well-established, the use of nanoscience and nanotechnology specifically for oral and maxillofacial surgery is still new. Within nanotechnology, two broad areas of research can be identified: the use of multi-functional therapeutic nanoparticles for head and neck cancer, and the use of nano inspired biomaterials for improving bony regeneration specifically for oral and maxillofacial surgery.Wadagaki et al investigated the feasibility of incorporating simvastatin into a biodegradable electrospun PLGA nanofibre scaffold as a drug delivery platform for bonyregeneration. Alkaline phosphatase activity in bone mar-row stem cells increased, with a simultaneous reduction in osteoclastogenesis. New bone also formed, and there was mineralisation and upregulation of osteoblastic differentiation. However, this technology suffers from increased cost and being technique sensitive.[12]So, we observed that more technological advancement is essential for incorporating regenerative technology which can prove as a milestone. Future research is required to make nanomaterials less technique sensitive and more cost effective. It is imperative for implementing course related to nanotechnology in the curriculum of the post graduate studies which will help the future budding dental professionals to be confident about this emerging technology.

CONCLUSION

Research to improve upon existing nanomaterials is still ongoing, with future directions towards more efficient and cost-effective nano-biosensing devices. Therefore, it is the need of the hour that clinicians especially oral surgeons are apt and updated with the knowledge of this nano-technology.

REFERENCES

1. Loizidou M, Seifalian AM. Nanotechnology and its applications insurgery. Br J Surg 2010;97:463–5.
2. National Science Foundation. Nanotechnology definition (NSET,February 2000). Available from URL: http://www.nsf.gov/crssprgm/nano/reports/omb nifty50.jsp
3. Taniguchi N. On the basic concept of nanotechnology. In: Proc Intl ConfProd Eng Tokyo, Part II. Japan Society of Precision Engineering 1974;1974: 18-23.
4. Pease RF. Electron beam lithography. Contemporary Physics1981;22:265–90.5.
5. He L, Liu B, Xipeng G, et al. Microstructure and properties of nano-fibrous PCL-b-PLLA scaffolds for cartilage tissue engineering. Eur CellMater 2009;18:63–74
6. Sharma, V.K., Trivedi, H., Bey, A., Gupta, N., 2016. Nanotechnology: rise of a new era in periodontics. Univ. J. Dental Sci.
7. Pradeepkumar, Y., Panishankar, K., Saraswathi, P., Saravanan, A., 2012. Current research in Nano periodontics. SRM J. Res. Dental Sci. 3 (1), 46.
8. Andreoni, W., 2000. The Physics of Fullerene-based and Fullerenerelated Materials. Springer Science & Business Media.
9. Tomsia, A.P., Launey, M.E., Lee, J.S., Mankani, M.H., Wegst, U.G. K., Saiz, E., 2011. Nanotechnology approaches for better dental implants. Int. J. Oral Maxillofacial Implants 26 (Suppl), 25–49.
10. Cheng, Z., Guo, C., Dong, W., He, F.-M., Zhao, S.-F., Yang, G.-L., 2012. Effect of thin nano-hydroxyapatite coating on implant osseointegration in ovariectomized rats. Oral Surgery, Oral Med., Oral Pathol. Oral Radiol. 113 (3), e48–e53.

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Received 25 April 2021; Accepted 08 May 2021.

11. Besinis, A., Hadi, S., Le, H., Tredwin, C., Handy, R., 2017. Antibacterial activity and biofilm inhibition by surface modified titanium alloy medical implants following application of silver, titanium dioxide and hydroxyapatite nanocoatings. Nanotoxicology 11 (3), 327–338.
12. Wadagaki R, Mizuno D, Yamawaki-Ogata A, et al. Osteogenic induc-tion of bone marrow-derived stromal cells on simvastatin-releasing,biodegradable, nano-to microscale fiber scaffolds. Ann Biomed Eng2011;39:1872–81