How to Cite:
Bhattacharjee, S., Prakruthi, R. A., Devi, K. B., Tiwari, H. D., Naorem, N., & Betha, S. P. (2022). Evaluation of knowledge of dentists on advanced dental equipment systems: An original research. *International Journal of Health Sciences*, *6*(S2), 2199–2204. https://doi.org/10.53730/ijhs.v6nS2.5445

Evaluation of knowledge of dentists on advanced dental equipment systems: An original research

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***Abstract*---**Aim: Purpose of the present study was to evaluate the knowledge of the dental professionals regarding the advancements in various dental equipment's as well as techniques. Methodology: Questionnaire study was conducted amongst 200 dental professionals with 78 of them being MDS and rest being BDS professionals. The questions were based on advanced dental equipment's and techniques. Descriptive statistical analysis was conducted with the data received. Results: 103 (62.5%) of the participants thought that the application of nanotechnology in dentistry will be supplemental, and 2.8% of the participants thought that nanotechnology will be

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.
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Manuscript submitted: 27 Jan 2022, Manuscript revised: 18 Feb 2022, Accepted for publication: 09 March 2022

useless in dentistry. Of the participants, 63.3% believed that there is a lack of clinical trials on nanotechnology-based approaches, whereas 32.3% believed that nanotechnology is affordable. 73.9% of MDS believed that this technology is painless and an effective treatment option as compared to 56% of BDS professionals considering Laser effective. Virtual reality and robotics proved to be a new field where only 21% felt that robotics may ease the procedure sensitivity as well as success of treatment. Conclusion: We observed that more MDS professionals were aware of advanced digitalized systems and use in clinical practice as compared to BDS professionals. Hence, more training is required for dental students at graduate level to equip them with the updated knowledge

***Keywords*---**nanotechnology, robotics, dental materials, advancement.

Introduction

Currently, dentistry is benefiting from the development of modern digital transformation. Three-dimensional (3D) digital technology as well as computer-aided design and computer-aided manufacturing represent modern-day dentistry.[1] Nevertheless, innovations have been introduced in the dental field to improve dental education and clinical activity. Augmented Reality (AR) and Virtual Reality (VR) represent some of these innovations and are part of the reality–virtuality continuum.[2] Commonly, traditional digital technologies in dentistry are structured into a three-step procedure which can be summarized as follows: (1) the digital image is acquired by a scanning device; (2) the operator can modify or change different dental aspect digitally, such as position or orientation of teeth; (3) the new information is transferred back to solid state or remain digital as a wax-up. With the introduction of AR and VR, these steps are simplified and implemented.[3,4] Although AR and VR possess many common aspects, the outcomes and the users' experience are completely different. Laser dentistry began to gain popularity only in 1990.[5] Since then, lasers have been used in all the disciplines of dentistry for the management of soft and hard tissues either as an adjunct to conventional technique or as a primary tool. On the basis of its clinical applications, lasers can broadly be divided into two categories: soft-tissue and hard-tissue lasers. Soft-tissue lasers mainly comprise of Co_2, diode, and neodymium lasers; employed chiefly in gingival and periodontal tissue management.[6] The use of lasers is one of these hallmark technologies that enables dentists to work faster, more precisely and more efficiently.[7] In soft tissue application, laser is employed for incision, excision, ablation, wound healing, removal of hyperplastic tissue to uncover impacted or partially erupted teeth, photodynamic therapy for malignancies, photo stimulation of herpetic lesions. Use of the laser proved to be an efficient tool to extend efficiency, specificity, ease, and price and luxury of the dental treatment. The most fundamental aspects of dental treatment is the restorative dentistry.[8] Many refinements and improvements in quality of various materials and processes used in the restorative dentistry came into existence with the beginning of 20*th* century.[9] For their use in dentistry, dental materials have been especially designed and are made of fabricated materials. The characteristics of different available dental

restorative materials vary according to their intended purpose.[10] With the advancement, number of new restorative materials have been discovered which have shown significant improvement in the quality of restoration like nanotechnology which is also known as molecular engineering or nanotechnology. It involves the production of functional materials and structures within the range of 0.1 to 100 nm by various physical or chemical methods. The use of nanomaterials stems from the idea that they may be used to manipulate the structure of materials which provide dramatic improvement in chemical, electrical, mechanical and optical properties. Nanofillers and Nanocomposites have been developed using advanced methacrylate resins and curing technologies. [11-13] Epoxy resin composite is one of the self-repairing or self-healing synthetic materials which is an advanced dental restorative material, which shows some similarities to resin-based dental material. If a crack occurs in the epoxy composite material, some of the microcapsules are destroyed near the crack and release the resin. The cracks were filed by resin and reacts with a Grubbs catalyst dispersed in the epoxy composite, which results in polymerization of the resin and repair of the crack.[14,15]

Modern digital technologies can potentially reshape dentistry both on an educational and clinical level. Students may improve their knowledge and practical skills. Dental clinicians may use these technologies as useful aids in their practice. It is imperative to know the amount of knowledge the dental professionals have about these advancements.

Aim of the present study

Purpose of the present study was to evaluate the knowledge of the dental professionals regarding the advancements in various dental equipment's as well as techniques.

Methodology

A descriptive study was conducted where around 200 dental professionals participated of which 90 were female dentists. Around 78 participants had done their MDS and rest were BDS graduates. An open-ended questionnaire format was emailed to 200 participants. The questions were in English language and they were based on advanced dental equipment's and techniques. The data received were entered in MS excel sheet and then subjected to descriptive statistical analysis including mean, standard deviation using SPSS 25.0 where p value less than 0.05 was considered significant.

Results

Regarding knowledge of the application of nanotechnology in dentistry, most of the MDS professionals (84.9%) thought that the use of nanotitanium implants increases the quality and success rates of implants, whereas 12.7% of MDS thought that the use of nanotitanium implants does not affect the quality and success rates of implants. 34% of the BDS participants thought that the application of nanotechnology in dentistry will be fundamental, 103 (62.5%) of the participants thought that the application of nanotechnology in dentistry will be

supplemental, and 2.8% of the participants thought that nanotechnology will be useless in dentistry. Of the participants, 63.3% believed that there is a lack of clinical trials on nanotechnology-based approaches, whereas 32.3% believed that nanotechnology is affordable. As far as LASER technology was considered, around 73.9% of MDS believed that this technology is painless and an effective treatment option as compared to 56% of BDS professionals considering Laser effective. However, in terms of cost effectiveness 81.5% of all participants felt that this advancement needs to be more cost effective (p=0.031). Virtual reality and robotics proved to be a new field where only 21% felt that robotics may ease the procedure sensitivity as well as success of treatment. Around 87.6% of all participants felt that more training is required in terms of dental curriculum.

Table 1- Descriptive data available from the present study

Variables	**BDS (Mean±SD)**	**MDS (Mean±SD)**	**p value**
Nanotechnology implants	3.33±0.44	2.54 ±1.33	1.34
Nanotechnology as supplemental	1.67±0.54	1.88±1.09	0.982
Affordability of nanotechnology	1.56±0.22	2.05±0.32	0.0478
Lack of clinical trials on nanotechnology	2.56±1.77	3.11±0.56	0.0104
LASER as painless treatment option	3.99±2.11	1.32±0.76	0.098
LASER cost effectiveness	2.22±0.91	1.89±1.05	0.031
Robotics as a better way for treatment	1.93±0.11	0.89±0.33	1.44
More training for Robotics	0.23±0.15	1.71±1.26	0.0214

Discussion

Digital dentistry has led to the development of many innovative technologies that can aid the dentist in communicating with the patient; for example, the spread of digital technology has simplified the step of creating a set of facial and intraoral photographs, both in the production phase of the images and in their archiving. Currently, different devices can be used to improve such patient–operator communication, as diagnostic and virtual wax-up allow for the visualization of the possible prosthetic treatment.[16] Apart from dental education, AR and VR may help to reshape clinical dentistry. Computer-generated information may be superimposed on the surgical field using AR and VR. These technologies may reduce the time needed for consulting digital information, but more importantly, they allow the clinician to focus on the patient. These innovative technologies can improve communication between dental practitioners, dental technicians, patients, and the multidisciplinary team. VR allows the clinician to demonstrate to patients the expected clinical outcome via a total virtual simulation. However, AR may allow for an immediate interaction between the dentist and patient.[17]

Currently, there is a growing awareness of the usefulness of lasers in the armamentarium of the modern dental practice, where they can be used as an adjunct or alternative to traditional approaches9. Kravitz and Kusnoto, who indicated that erbium and diode lasers are the two most popular types of lasers that are used in dentistry. Most of the practitioners reported that patients were highly satisfied with the treatment when lasers were used.[18] The conventional dental materials have been acquisitive for long, which means they were developed elsewhere for different purposes, and following the principles of 'adopt, adapt, improve', sometimes with idiosyncratic and personal recipes of individual practitioners, have been introduced in clinical practice. The evolution and exponential diffusion of digital technologies allowed the development of special materials to be used for CAD/CAM systems. These materials with a digital vocation are more "sophisticated" than those used in analogue techniques. The important goal in dentistry is to provide best dental care to the patients. Day by day, science is undergoing great revolutions that are leading the humanity towards a new era of dentistry. Nanotechnology is introduced in conventional GIC and resin-modified GIC to improve the mechanical properties of GIC. The development and implementation of composite dental restorative materials rely on a comprehensive understanding of each component of the composite and consideration of methods for changing each component. The need to improve shrinkage properties and wear resistance is obvious for dental composites and a vast number of attempts have been made to accomplish these aims.[19] In our study, we observed that more MDS professionals were aware of advanced digitalized systems and use in clinical practice as compared to BDS professionals. Hence, more training is required for dental students at graduate level to equip them with the updated knowledge.

Conclusion

Modern digital technologies can potentially reshape dentistry both on an educational and clinical level. Students may improve their knowledge and practical skills. Dental clinicians may use these technologies as useful aids in their practice.

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