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Importance of Nanorobotics in Dentistry

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Short Communication

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ABSTRACT

Nanorobotics is anticipated to play an important role in future of healthcare. Using Nanorobots in dentistry is expected to enhance accuracy, reproducibility and reliability. Nanodentistry is the most recent application of nanotechnology that has proven to be beneficial for diagnosing, treating, and preventing oral and dental problems. In recent years, with the emergence of new technologies in dentistry, the potential to alter dental practice in a variety of ways has been enhanced. Nanodentistry, with the use of nanorobotics, nanomaterials and biotechnology may soon be able to maintain near perfect oral health. These machines usually show up in different sizes from 1.0 to 100.0 nanometres. Dental nanorobots might be trained to crawl and swim within human tissue using a unique motility mechanism. Nanorobots use is diversified; however, in dentistry its role is very significant. Despite the fact that Nanorobot research and clinical trials are still in their premature phases, researchers are positive about their potential use in dentistry.

INTRODUCTION

Increasing interest in the future of nanotechnologies in dental applications has led the development of a new area known as Nanodentistry [1]. Nanorobotics is a smart system made up of nanostructured materials that range from 1.0 to 100.0 nanometres in size and have an overall size of less than a micrometre. According to the nanorobotic theory, computer-controlled microscopic devices must collaborate to complete both microscopic and macroscopic tasks. Nanorobots in the long run [2] provide fast diagnosis, eradication, individual cell surgery *in vivo* and natural physiological function improvement. The several dental applications like re-alignment and straightening crooked teeth, improving tooth durability, oral analgesia [3], desensitizing teeth can be achieved. Thus, they can be used in preventive, operative, curative and tooth restoration procedures. Nanorobotics are generally utilised to construct and implant biologically regenerative replacement teeth which includes mineral and cellular components, resulting in comprehensive dentition replacement treatment. According to the researchers, dental nanorobots can be used to eradicate caries-causing bacteria as well as to heal tooth defects. As nanorobots are not visible to the naked eye,

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imaging techniques like Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM) are used to examine them [4].

Historical background

During the first decade of the 20th century, Zsigmondy made a first detailed observation and size measurement of nanoparticles. Nanorobotics is a rapidly developing field that emerged in the late 1990s. In the late 1990s, the word "nanorobot" was coined by the robotics community [5]. Expert created the term nanotechnology. Eric K. Drexler and Robert A. Freitas are two leading innovators in nanorobotics. They are robotic devices that can accomplish tasks at the nanoscale. Nanorobotics has gradually evolved to encompass the elements as nanorobotic system design, fabrication, programming, and control of robotic system. It became famous among the common people with the help of science [6] fiction films, televisions shows and literature. Richard Feynman, a Nobel Prize-winning physicist, investigated the consequences of matter manipulation in 1959. In 1959, he declared at the American Physical Society, that "There is plenty of room in the bottom". He ended his speech by noting, "I believe this is a development that cannot be averted." Freitas presented his nanodentistry hypothesis, which he defines as "the science and technology that allows for the preservation of excellent dental hygiene.

Mechanism of action

Nanorobots are made up of a variety of components like carbon, hydrogen, sulphur, oxygen, nitrogen, silicon and fluorine. Carbon (C) in the form of diamond [7] is the most prominent element on the nanorobots outer surface. The other elements are employed for a variety of purposes, including nanoscale gears and the manufacture of other components. Propulsion in the body might come from glucose or other natural alternatives, along with oxygen. They have specialised biochemical or molecular components based on the work to be accomplished [8].

Nanorobots may be powered by metabolizing

- Glucose
- Oxygen
- External acoustic energy

Remaining internal power might be employed to provide the required energy to the gadgets. These devices might be programmed to function with on-board processors that can execute 1000 or more computations per second. These computers will be able to maintain and stockpile the records and also be able to carry out preplanned activity. Broadcast-type auditory signals can be used to communicate with the device. A navigational network might be implanted in the body to offer a clear image of passing nanorobots so that their whereabouts can be tracked. This makes it easier for clinicians to keep track of all the different sensors throughout the body. These nanorobots might be capable of distinguishing among various cell types by studying cell surface antigens. Chemotactic sensors attached to particular antigens on target cells are used to achieve it. When the nanorobots have served their mission, they may be eliminated by allowing them to pass *via* normal human excretory pathways or active

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scavenger systems can also get rid of them [9]. According to current theories, dental nanorobots should be able to communicate in at least two ways with the doctor who is in charge of the coordination and it should join forces with the other nanorobots.

The following are the four major components of nanorobots:

- Camera
- Payload
- Capacitor
- Swimming tail

CONCLUSION

Several nanorobot designs have been proposed, but multi-armed spider-like arrangement appearing to be the most optimal design since they are speedy in completing their task and are also in multitasking. Diamondoid structures are used to make these nanorobots. The surface must be very-smooth so that when nanorobot is implanted inside the body, it does not provoke immune system, allowing them to function effectively. A nanocomputer in the dental nanorobot will perform pre-programmed duties, accept process signals, communicate and react to various tracking devices. It makes sure that nanomechanical components work properly. The manufacturing process will include sensing devices, actuator, control, fuel, communication, also interfacing beyond spatial scales and in organic or biotic systems.

REFERENCES

1. Misch CE. Contemporary implant dentistry. Implant Dent. 1999;8:90.
2. Kumar A, et al. Recent trends in solid waste management status, challenges, and potential for the future Indian cities: A review. Curr Opin Env Sustain. 2020;2:100011.
3. Saini S, et al. Effective and sustainable solid waste management in India: A challenge. Microbial Tech Health Env. 2020;21:267-287.
4. Sharma HR, et al. Sustainable solid waste management in India: Practices, challenges and the way forward. In climate resilience and environmental sustainability approaches. 2021;2:319-349.
5. Beohar P, et al. Fluoride content distribution in the underground water of Central India Madhya Pradesh. Eng Technol India. 2013;4:36-39.
6. Hillebrand H. On the generality of the latitudinal diversity gradient. Amer Naturalist. 2004;163:192-211.
7. Hillebrand H et al. Body size determines the strength of the latitudinal diversity gradient. Ecography. 2001;24:251-256.
8. Guenster N, et al. The economic value of corporate eco-efficiency. Eur Fin Mgmt. 2011;17:679-704.
9. John D, et al. Global limnology: Up-scaling aquatic services and processes to planet earth. SIL Proceedings. 2009;30:1149-1166.