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USE OF NANOROBOTS IN ORAL MEDICINE

*[1]MONICKA , [2]NALINI ASWATH, [3]V SHREYA
[1]POST GRADUATE STUDENT , DEPARTMENT OF ORAL MEDICINE AND RADIOLOGY, SREE BALAJI DENTAL COLLEGE AND HOSPITAL,
[2]HEAD OF DEPARTMENT , ORAL MEDICINE AND RADIOLOGY, SREE BALAJI DENTAL COLLEGE AND HOSPITAL
[3]SAVEETHA MEDICAL COLLEGE, SAVEETHA INSTITUTE OF MEDICAL AND TECHNICAL SCIENCES

ABSTRACT
Nanorobots as nanites or nanomachines they are minuscule devices that are measured in nanometers (1 nm is one millionth of one millimeter). The nanorobot is probably going to be constructed from carbon atoms in a diamond-like structure because diamond particles are strong and chemically inert. Nanorobotics is a field where microsocopic robots will be created to perform medical and dental procedures. Nanorobots to be made up of "smart" structure which will have the ability of inciting, sensing, signalling, processing information and perform the required treatment at nano scale. Gaining access to robotics at nano level in the dental world, the aim will be to treat dental conditions rapidly and more efficiently, by causing minimum pain. Dental nanorobots could be built to eliminate bacteria that causes dental cavities or to fix tooth imperfections where decay has already begun. Nanomedicine is the term given to this branch of medicine that is rapidly emerging from nanotechnologies.

INTRODUCTION

Utilizing logical information to control and utilize problems at the nanoscale, where size-related processes and peculiarities may occur, is known as nanotechnology. Using atomic devices and subatomic data about the human body, nanomedicine is used to diagnose, treat, and prevent disease and severe injury, to ease suffering, and to preserve and improve human wellbeing. The nanodevices used to protect or treat humans against microorganisms are called nanorobots. It is a small device designed to perform a particular task or occasionally errands accurately at nanoscale aspects of 1-100nm. They are expected to carry out tasks in both clinical and contemporary fields at the nuclear, subatomic, and cellular levels.
previously Microrobots, or tiny robots smaller than a micrometer, offer a workable solution for overcoming these constraints and reshaping oral disease treatment once more. Microbots may be made from biocompatible materials such as metals (such as gold or titanium), polymers (such as hydrogels or poly (lactic-co-glycolic corrosive)) , and earthenware (such as silicon or hydroxyapatite). Their size, which typically ranges from 1 to 1000 micrometers, allows them to explore the intricate and highly stressed oral cavity and penetrate deep tissue regions or blocked off cancers.

STRUCTURE OF NANO ROBOTS

A strand of double-stranded DNA is affixed to an antibody that is particular to one of the surface proteins in every component of this robot. The robot's antibody parts attach to the corresponding proteins in the collection of cells when these parts are added, causing the robot to function in a particular way.
A functional robot is present in cells when all three components are joined, and a fourth component aids in starting a chain reaction among the DNA strands. Up until the last antibody receives a strand of fluorescently tagged DNA at the conclusion of the exchange, each component swaps a DNA strand with another..

TARGETED DRUG DELIVERY FOR ORAL CANCER

For medication delivery and determination, biochips are used. It is a fusion of novel biomaterials, photolithography, and nanotechnology. This is the new planning approach for nanorobots used in electronic projects. One of the most exciting uses of nanorobots in the treatment of oral disease and oral lesions is the distribution of designated prescriptions. Microbots may be the embodiment of useful substances such as photosensitive drugs for photodynamic therapy, radioactive isotopes for targeted radiotherapy, or chemotherapy prescriptions [7] in treatment for oral cancer. Materials used to construct oral drug delivery microbots should possess the ability to protect drugs from degradation by gastric mucus and withstand the harsh environment of the gastrointestinal tract, allowing for targeted delivery to oral cancers [19].

ORAL CANCER DETECTION WITH NANO ROBOTS IN ORAL CAVITY

By using nanorobots equipped with fluorescent dyes or differentiation for demonstrative imaging, oral cancer location and premalignant lesions in the oral cavity detection may be improved. They can reach deep tissue regions and provide constant information on growth properties like size, area, and blood flow. This information may be extremely helpful for scheduling meticulous tasks, monitoring treatment reaction, and ordering

medications. Microbots—little robots on the micrometer scale—offer a potentially useful method for working on the identification of oral disease finding by utilizing fluorescence or differentiation for symptomatic imaging. Compounds with contrast for use in computed tomography (CT) nanorobots that resemble iodinated contrast specialists may be stacked to enhance attractive reverberation imaging (X-ray) and further develop picture contrast on CT scans. nanorobots emit fluorescence in the oral cavity using gold nanorod-coated algal biomaterial and fluorescent dye, controlling temperature and movement with lasers, and stimulating cellular processes.

ADVANTAGE OF NANOROBOTS IN DETECTION OF MALIGNANCIES

Microbots, equipped with fluorescent or different colors, can be more delicate in spotting small tumors or lesions potentially contributing to early cancer detection. They can identify biomarkers and provide a less intrusive alternative to meticulous biopsies, allowing patients to recover more quickly. Continuous imaging strategies can coordinate microrobots to target suspected areas. By investigating difficult-to-reach areas of the mouth, microrobots may one day contribute to the early detection of dangerous cancers—a departure from traditional biopsies

BENEFITS OF USING NANOROBOTS IN ORAL MEDICINE

Benefits of Nanorobotics

1. Less time spent recovering
2. No tissue damage or injury
3. Less post-functional thought
4. Consistent throughout the body examination
5. Prompt response to the therapy
6. Saving data and viewing the model in real time.
7. The model aids in identifying the onset of illness.
8. Drug transportation from payload

NANOROBOTS USED FOR SKIN DISEASES

Skin Conditions It is possible to treat skin conditions with a cream that contains nanorobots. It eliminates dead skin and excess oil, replaces lost oil, applies the perfect amount of typical soaking combinations, and, yes, even manages to accomplish the modest goal of "significant pore cleaning" by actually penetrating pores and extracting them. The cream might be a clever substance that is comfortable to wear and remove with ease.

NANOROBOTS IN DIAGNOSIS OF ORAL MALIGNANCY

Identification and treatment of oral cancer Saliva is used as a low-cost, non-invasive symptomatic medium that has genomic and proteomic markers to distinguish evidence of atomic infection. One of these markers whose level is elevated in danger is the exosome, a secretory vesicle bound to film. Nanoparticles have been used to concentrate this marker. Oral liquid nano-sensor testing, optical nanobiosensors, and nanoelectromechanical frameworks can also be used to diagnose oral cancer. Tiny dabs known as nano-shells are specifically used in cancer treatments..

RECENT ADVANCEMENTS OF NANOROBOTS IN ORAL MEDICINE

Recently, nanorobots such as DNA origami nanorobots and chemotaxis-guided hybrid neutrophil micromotors have shown remarkable potential for precise drug delivery within the oral cavity . These advancements, which are driven by chemical reactions or magnetic fields, allow for precise dosing and regulated release of medication, improving the effectiveness of treatment for oral infections. Additionally, biocompatible and biodegradable components are incorporated into nanobots to guarantee security and effective breakdown following treatment, resolving worries about chronic buildup and inflammatory responses.

FUTURE OF NANOROBOTS

It is envisaged that in addition to delivering antibiotics, future nanobots will also combine regenerative materials and anti-inflammatory medications at the same time. This method seeks to promote tissue repair, lessen inflammation, and fight infection in concert. Multifunctional nanobots have the potential to revolutionize treatment outcomes in oral healthcare guidelines for ethical use in clinical settings. For example, they could use stimuli-responsive mechanisms to release antibiotics upon detecting specific pathogens within oral biofilms. This targeted therapy approach minimizes systemic side effects while maximizing therapeutic efficacy. To increase public acceptance of nanobot technology and foster public trust, research and development practices must be transparent. Ethical discussion should also address socioeconomic gaps in healthcare delivery by concentrating on fair access to nanobot-based treatments. To navigate this, cooperation between researchers, oversight organizations, and healthcare providers is crucial.

CHALLENGES FACED BY NANOROBOTS

Accurate placement and assembly of the molecular scale component

- Cost-effective method for mass producing nanorobots
- Biocompatibility Large-scale independent micron-scale robots coordinating their activities simultaneously
- social issues pertaining to public acceptance, ethics, regulation, and human safety

- extremely high design costs

CONCLUSION

Nanoassemblers are tiny devices that can be programmed by a computer to carry out specific tasks. To fit into areas that are difficult to access with the human hand or other forms of technology, the nanoassemblers might have a smaller size than the nucleus of a cell. nanorobots in the diagnosis and treatment of oral infections, providing a focused and effective method of medication delivery and identification of potentially cancerous lesions in the oral cavity. Nanobots can improve the concentration of therapeutic agents at the infection site and lessen systemic side effects by specifically targeting bacterial biofilms in the oral cavity. Nanobots have the potential to revolutionize oral healthcare as technology develops further by offering creative answers to persistent problems with treating oral infections. With further study and development, nanobots have the potential to completely transform

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