

Review Article

A short review of use of nanotechnology in periodontics

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Abstract

Nanoscience or nanotechnology refers to the development and research of an applied science at the atomic or molecular level. Nanotechnology is developing fast in recent years and like other medical fields it is also set to transform dentistry in a huge way. It is now considered as a multidisciplinary field of scientific research. Different types of nanomaterials, nanoparticles, nanodivices and its applications are of human interest. Nanodentistry can make maintenance of oral health by employing the nanodivices which will allow precise control on various techniques in oral care like oral analgesia, dentine replacement therapy, permanent hypersensitivity cure, periodontal cure and complete orthodontic realignment etc. Nanotechnology and its application in periodontics have improved the diagnosis, treatment, prognosis and prevention of the periodontal diseases. It utilizes nanomaterials, nanobiotechnology and nanorobots for the treatment and maintenance of periodontal health. The purpose of this paper is to review the phenomenon of nanotechnology as applied to periodontics.

1. Introduction

Greatness does not come from size and surprises come in small packages. 'Nanotechnology' includes structures ranging in the size of 100 nanometers or smaller in at least one dimension and other developing materials or devices within that size, like grains less than 100 nm in size, fibers that are less than 100 nm diameter, films less than 100 nm in thickness, nanoholes, and composites. The word 'nano' is derived from a Greek word meaning 'dwarf'. The late Nobel Prize winning scientist Richard P. Feynman established the potential of nanosize devices in 1959.[1-3]

According to the definition of the National Nanotechnology Initiative, nanotechnology is the direct manipulation of materials at the nanoscale. This term defines a technology that enables almost complete control of the structure of matter at nanoscale dimensions.[4]

The central idea of nanotechnology is to employ individual atoms and molecules to construct functional structures. Nanotechnology has revolutionized all fields including health care to engineering beyond traditional and dentistry is also no exception. The speed at which progress has been made in science has introduced nanotechnology to dentistry from its theoretical basics instantly into the actual world.[1]

Nanotechnology can be utilized in dental practice. Nanomaterials can replace the diseased dental tissue and nanotechnology can be used for targeted drug therapy to attack target tissue cells. With the use of stem cell therapy tissue reconstruction can be done after major resection of diseased tissue as in oral cancers and major inflammatory diseases like osteomyelitis.[5]

2. Nanotechnology use in periodontics:

2.1 Dentin hypersensitivity cure:

Dentin hypersensitivity usually caused by changes in pressure and transmitted hydrodynamically to the pulp. The important fact, that hypersensitive teeth have tubules diameter double than nonsensitive teeth and about eight times higher surface density of dentinal tubules.[2]

Dental nanorobots can precisely and selectively occlude selected tubules in minutes, using native biologic materials, offering patients a quick and permanent cure.[2]

2.2 Nanomaterials to Induce Bone growth:

Bone is a natural nanostructured composite composed of organic materials like collagen reinforced with inorganic ions in the form of hydroxyapatite crystals. This natural nanostructure uses the nanotechnology to emulate for dental applications. As the particle size decreases, the surface area becomes larger in volume. Nanobone uses this basic principle of nanostructure.[4]

2.3 Nanomaterials for Periodontal Drug Delivery:

Nanomaterials that are widely used for controlled drug release are core-shell spheres, hollow spheres, nanotubes and nanocomposite.[4] Drugs can be incorporated into nanospheres composed of a biodegradable polymer, and this allows for timed release of the drug as the nanospheres degrade facilitating site-specific drug delivery.[4]

2.4 Nanotechnology in dental Implants:

Surface modifications of dental implants can be done by nanotechnology as surfaces properties such as roughness and chemistry play a determinant role in achieving and maintaining their long-term stability in bone tissue.[4,6]

The most common reason for failure of dental implant is the deficient formation of bone around the biomaterial immediately after the implantation. With the use of coating of nano particles over the dental implants, adhesion and integration of surrounding tissues is improved.[7]

3. Laser Plasma Application for periodontia:

Use of nano-sized Titania particle emulsion on human skin followed by laser irradiation, leads to the disintegration of the particles along with other results like:

- Shock waves
- Microabrasion of hard tissues
- Stimulus to produce collagen.[8]

Clinical applications of this laser plasma application in periodontia are Periodontal therapy, melanin removal and soft tissue incision (without anesthesia).[9,10]

4. Conclusion

Nanotechnology can become a predicted future in which dentistry, including periodontal practice and periodontal therapies may become more high-tech and more effective. However comprehensive research facility must be made available to meet the rigorous requirements for the development of nanotechnologies.

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