

NANO TECHNOLOGY PRESENT AND FUTURE IN HUMAN HEALTH CARE

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ABSTRACT:

The practice of periodontology has been significantly influenced by the shift in therapeutic concepts from resection to regeneration. The practical procurement of the goal of complete regeneration of the periodontal tissues could not be achieved for many years. However the advancements and research in nano materials and technology has provided an optimistic insight has been recently provided by advancements and research in nano materials and technology leading to commercial application of this technology in managing the periodontal diseases. Various metallic and polymeric materials structured in nano scales and nano materials are developed to form an ideal scaffold interfaces with the tissues which provides a new horizon in the periodontal therapy. Nanomaterials provides promising results in the treatment of dentinal hypersensitivity, in dentifrices, nano fibers can be used as an support to conventional fibers for local drug delivery and tissue engineering scaffolds, and nano textured implant surface. Thus a reasonable and much bright insight into the commercial application of the nano materials and technology in the treatment and management of periodontal disease has been provided by the recent development in the nano materials and nano technology

KEY WORDS: nano technology, nano medicine, nano robots, nano dentistry

INTRODUCTION:

In order to maintain and restore normal function of injured and diseased tissues scientists are looking forward towards new technologies for the construction of biological substitutes by applying the basic principles of bioengineering, transplantation of cell and combining material sciences with the two.(1)The main clinical issue in the development of the more pure and technically rectified means is the delivery of medications to specific concerned site at the therapeutic level .with advancing age the prevalence of periodontal destruction increases so in the field of dentistry such technologies are continually needed (2)the progressive periodontal disease can be managed successfully if the scaling and root planning along with the flap surgery is combined by proper postoperative supportive periodontal care (3) Because of its economic potential and the scientific significance the regenerative treatment of periodontal defects has become the major interests of the material scientist and has tempted many organizations toward it (4) One of the emerging areas is tissue engineering that seeks to develop techniques and materials to aid in the formation of new tissues to replace damaged tissues (5) Guided tissue engineering has been successfully used in the treatment intra bony defects and furcation defects(6). A more general review of tissue engineering concepts in terms of periodontal regeneration has been carried out by Bartold(5).In the recent past many materials both polymeric and metallic which are structured in nanoscales have made a significant and noteworthy progress and lead to the establishment of certain biomaterials which can form interfaces that are ideal with the tissues (7) The nano materials have been found to be very useful in three dimensional cell

culture and tissue engineering (2) this interface that is the combined use of nano technology and biological techniques is very useful in the management of various periodontal disease and helps in the evaluation of cellular components of hard and soft tissues i-e mandible/periodontal ligament and tibia/patellar tendon (8)A nobel physicist Feynman introduced the basic vision of nano technology in 1959 he defined nano technology as a technology of billionths of a meter (9) the term “nano technology ” was first coined and introduced by Norio Taniguchi in 1974 in a conference paper . the prospective of molecular nanotechnology was promoted by Drexler in a book named as “engines of creation “ in 1986 (10).“Nano” is a derivative of Greek word meaning “dwarf” the technology is basically defined as the utilization and creation of devices materials and systems established by controlling matter on the nano meter scale (1-100 nm) which is the the level of atoms, molecules, and supra molecular structures(11)However, nanotechnology cannot be restricted to just study of nano things on a nano scale rather it is much more than that its is not merely a simple study it is an advancement and exploration of materials various devices showing chemical biological and physical properties that are unique and different from those found on a large scale (3) Nano technology is equally effective in both micro machine production devices and analysis of single cell in clinical research area due its utilization of nano volumes the analysis of molecular structures including DNA and RNA in the analysis of proteins or peptide linkages and in separation techniques like chromatography it is found to be very useful .the detection of early tumours can be done by this technique easily and effectively (12). The impact and effect of nano materials on the health of human is a big question mark on the way of continued sustainable development the risk assessment method need to be discovered (13). Together both biology and nanotechnology is called as nano-biotechnology. In the field of dentistry the nano technology is found to be effective in the local anesthesia application, providing cure for hypersensitivity, single visit realignment of teeth and by the use of dentirebots the oral health can be provided and monitored on regular basis it helps in cessation of caries and helps in the removal of blemishes of the decay (14) the main focus of this paper is to highlight the role of nano technology in the field of periodontics and oral care

DISCUSSION:

By the integration of five different systems including genetic engineering biotechnology complex machine systems and eventually nano particles and nano robots the field of nano medicine has emerged which is now been used as a tool for not only diagnosing complex diseases but also for there treatment and hence preventing the disease from occurring and expanding it helps in relieving the pain and preservation of healthy tissue is being made possible by this. (11)). All the five sub disciplines overlap each other in means of technology By the help of nano robots and small nano structured particles it has been made possible to diagnose the disease at early level hence preventing its spread and expansion the disease is being diagnosed at the very basic level that is cellular level. The stem cells can also be labeled and hence nano robots are acting like tracers too (15)The artificial small phagocytes also known as nanoroboticmicrobivores are helpful in digesting the bacteria viruses and pathogens that are

unwanted by patrolling in the blood stream (10) Inside the human body nano particles can act like mini surgeons when introduced into the blood stream through the vascular system if it is controlled by human it will help in detecting the site of pathology and treating the lesion through nano manipulation (15). The comprehensive oral health can be maintained by actively combining and integrating different technologies with the nano technique by employing the effect of biotechnology tissue engineering and dental nano robotics a comprehensive oral health can be maintained it can also be employed further in different treatment plans and techniques like application of local anesthesia the cure for hypersensitivity and denaturalization of dentition single visit orthodontic treatment will be its potential outcomes. The dental nano robots acts on programmed instructions that are controlled by nano computers as a result they execute preprogrammed instructions they swim through the tissue once inserted through vascular system and manipulate their surroundings by acquiring energy sense the cyto penetration achieved by them is considered as safe and hence they can alter nerve impulse in individual nerve cells in no time The acoustic instruction can also be used for directing the nano robots .

(16) Nanotechnology helps in periodontal management by regenerating the tissues through tissue engineering this basic concept was put forward by Kong in 2006 The main causative agent for dentinal hypersensitivity is the transmission of pressure to the pulp. The diameter of the dentinal tubules becomes eight times greater in surface density in the hypersensitive tooth than in non sensitive teeth. The nano robots are used to block these tubules selectively by using native materials that is used for permanent relief to the patients and is quite quick in action

(17) Dentirebots are helpful in metabolizing the organic particles that are trapped in sub gingival plaque if they are made as active ingredients of toothpaste or mouth wash they convert the organic matter into odorless and harmless vapors the nano dentifrices robots works by identifying and scanning the harmful agent and thus destroying it. Being completely safe the small sized particles approx(1-10 μ) crawl at 1-10 μ /s and will deactivate themselves if swallowed(15). The periodontal diseases have found to be best treated by nanoparticles loaded with triclosan they are found to reduce the inflammation caused by harmful bacteria the nano sensors and nano switches are important ways of nano delivery. The drugs can be delivered by timely release system the nano spheres is composed of polymer that is bio degradable (16). The genetic predisposition can be easily identified by the researches made in proteomics and genomics which is used for eliminating the disease y understanding the molecular basis. Nanotechnology is considered as the most cost effective and efficient diagnostic tool (17) The main focus of regenerative medicine and engineering is to make the strategies that will help in the regeneration of the human tissues. A drastic progress has been made in the respective field with the technological advancement and the introduction of various materials both metallic and polymeric in nature which are structured at nano scales (7). Hence it is concluded that nanotechnology is much more than simply the study of small things rather it is the whole world comprising of the development of various materials and devices and the systems that exhibit properties much different than large particles. (15). Harnessing bone capability to regenerate is the most challenging feature in the bone transplantation which is performed on wide scale

annually world wide a porous structure is required to provide the support to the cell and the guidance for bone formation is provided by it. three basic steps are involved in the regeneration of bone that are Osteo conductive matrix (scaffold) which is the primary and the decisive step second is the osteo inductive signals and thirdly osteogenic cells that can respond to these signals, and an adequate blood supply(18)With the advent of nano technology the drug delivery has been made easier it acts by scaffolding like seed into the cell. It can either attach directly to the cell or at like a gel sort vehicle and enter through the porosity(18) Nanotechnology is used for the formation of nano bones which can be used in periodontology and helps in the treatment of many bone problems the bone is basically made of collagen which is composed of collagen proteins known as tropo collagen it is further modified by adding the molecules of silicon which enhances the protein adsorption (19)Due to its unique properties such as wet ability and adherence nano particles are found to be quite useful in implant technology as it has very good stability and a potential for bone growth addition of calcium and hydroxyappetite crystals will further enhance the properties and efficiency (20)The fibroblast proliferation has been enhanced by using a vector with nano sized calcium phosphate particle (21)

Conclusion

The potential of nano technology in various fields of health care cannot be denied it provides a promising advancement in the field of both dental and medical sciences providing high quality care

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