ISSN: 2157-7439
Journal of
Nanomedicine & Nanotechnology

Commentary

Significant Advancements in Nanotechnology for Medical Implant Expansion

Wei Ji*

Department of Science and Technology, Queensland University of Technology, Australia

COMMENTARY

Funding agencies all over the world are pouring money into the development of nanotechnologies and devices. Diagnostic tools, drug delivery, and prostheses and implants are three uses of nanotechnology that are in high demand and particularly well adapted to biomedicine. This presentation presents a detailed summary of the most important accomplishments and new advances in the field of prosthesis and implants. Nanomaterials and their potential impact on the production of a new generation of durable and long-lasting implants in orthopaedics, dentistry, cardiology, podiatry, and other fields. The role of nanomaterials as scaffolds in inducing a more favourable interaction between implants and human cells is highlighted in particular. These nanostructured materials have opened up a new field of research. Implants that are biocompatible, long-lasting, robust, and bacterial and mechanically resistant are designed. However, more research on the long-term health impacts of nanomaterials is required, as well as rigorous clinical safety research.

DESCRIPTION

Tissue engineering is the use of engineering and life science principles and technologies to make living tissue to replace or repair the skin of a failing organ or a damaged or missing bodily part. Langer and Vacanti coined the phrase tissue engineering to describe the production of biological substitutes that maintain, improve, or restore tissue function in the general scientific community in 1993. Tissue engineered goods are usually made up of three parts: isolated cells, an extracellular matrix, and signal molecules like growth factors [1]. By retaining a three-dimensional space for the creation of new tissues with suitable function, the term'scaffold' presents new possibilities for the extracellular matrix. The interaction of cells with the extracellular matrix is well understood is extremely important for the final product's intended function. Polymers with excellent physical properties such as high surface area, high porosity, interconnectivity pores of nanofibre matrices with well-controlled degradation rates, and biocompatibility of the base polymer make them an ideal candidate for tissue engineering scaffold development.

When particulate matter is reduced to 100 nm or smaller, physical and chemical properties of ordinary macro-materials differ significantly from those of smaller nano-materials. In particular, phenomena such as the quantum size effect become more prominent. The underlying principle of increased surface area to volume ratios allows nanophase materials to interact with surrounding structures in more favourable ways. Several studies have found that the nanocrystalline layer promotes the development and bonding of surrounding bone tissue [2].

In vitro studies have also demonstrated that bone-forming cells adhere better and deposit more calcium on nanometer-sized materials than on micrometre-sized materials. The formation and maintenance of the body require the proper, coordinated operation of both types of cells healthy bony tissue and, as a result, a strong attachment between the implant and the surrounding bone this is especially crucial for implants that are not secured with bone cement. Artificial hips, which are often comprised of titanium or cobalt and chromium alloys, could benefit from a thin covering of nanocrystalline structure to assist alleviate the problems of wear and implant loosening. This nanocrystalline structure is harder, smoother, and has a better binder, which means the artificial socket, which is often composed of a special form of polyethylene, is more resistant to wear [3].

Hydroxyapatite is a natural component of bone, with the mineral hydroxyapatite accounting for 70% of the total and organic fibres accounting for the remaining 30%. Coating hydroxyapatite with nanometer-sized grains rather than micrometer-sized grains makes it more biocompatible and similar to natural hydroxyapatite in bone, which has a nanocrystalline structure as well. A nanoparticle was originally proved in Maastricht University Hospital in 2000, using an artificial hip with a hydroxyapatite nanocrystalline layer, that hydroxyapatite can be used to repair the bony tissues of injured bones. Aside from hydroxyapatite, other materials used to manufacture implants include diamond and metal ceramic.

For bone repair and regeneration, nanoparticles such as calcium triphosphate, bioactive glass, hydroxyapatite, synthetic chitin,

---

*Correspondence to: Wei Ji, Department of Science and Technology, Queensland University of Technology, Australia, E-mail: jiwei3@gmail.com

Received: 3-May-2022, Manuscript No: jnmnt-22-16477, **Editor assigned:** 6-May-2022, Pre QC No: jnmnt-22-16477 (PQ), **Reviewed:** 20-May-2022, QC No: jnmnt-22-16477, **Revised:** 23-May-2022, Manuscript No: jnmnt-22-16477 (R), **Published:** 30-May-2022, DOI: 10.35248/2157-7439.22.13.619.

Citation: Ji W (2022) Significant Advancements in Nanotechnology for Medical Implant Expansion. J Nanomed Nanotech. 13: 619.

chitosan, and biodegradable polymers have been synthesized into porous three-dimensional scaffolds. This method not only allows for a composition that is similar to bone, but it also improves the material's mechanical strength and nanopographic properties. Great tensile strength, high flexibility, and low density are all advantages of using polymer ceramic matrices containing single or multi-walled carbon nanotubes to generate more successful orthopaedic implant materials. The mechanical characteristics and biocompatibility of implants can also be improved by incorporating a nanostructure into the implant material [4]. An antiseptic effect is provided by a thin layer of titanium dioxide with nanopores and slowly released copper ions, which helps to minimise bacterial infections, which are a common issue with implants. Another option is to use a sintering method to create the implants from nano powders of titanium dioxide or aluminium oxide. Organic polymers having a nanostructure and composite materials comprising organic polymers with carbon nanofibres or titanium, aluminium, or hydroxyapatite nanoparticles are promising alternative materials. Organic polymers have the benefit of progressively dissolving as new skeletal tissue is being created, mimicking the natural process [5].

Acknowledgement

None

Conflict of Interest

None

REFERENCES

1. Skarzynski H, Lorens A, Matusiak M, Porowski M, Skarzynski PH, James CJ. Partial deafness treatment with the nucleus straight research array cochlear implant. Audiol Neurootol. 2012; 17(2):82-91.
2. Balkany TJ, Whitley M, Shapira Y, Angeli SI, Brown K, Eter E, et al. The temporalis pocket technique for cochlear implantation: an anatomic and clinical study. Otol Neurotol. 2009; 30(7):903-907.
3. Balkany TJ, Connell SS, Hodges AV, Payne SL, Telischi FF, Eshraghi AA, et al. Conservation of residual acoustic hearing after cochlear implantation. Otol Neurotol. 2006; 27(8):1083-108.
4. Von Ilberg CA, Baumann U, Kiefer J, Tillein J, Adunka OF. Electric-acoustic stimulation of the auditory system: a review of the first decade. Audiol Neurootol. 2011; 16(2):1-30.
5. Roland JT Jr, Huang TC, Cohen NL. Revision cochlear implantation. Otolaryngol Clin North Am. 2006; 39(4):833-839.