"Nanostructured BIOGLASS"- A Prominent Choice for Orthopaedic and Dental Implants

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PLENARY LECTURE

Nanostructures are at the leading edge of the rapidly developing field of material science in nanotechnology with many potential applications in clinical medicine and research. Due to their unique size-dependent properties nanostructures offer the possibility to develop both new therapeutic and diagnostic tools. In particular, nanoscale materials play a prominent role in both orthopaedic and dental implants. An effective approach to bone tissue engineering aims to restore function to diseased or damaged bone tissue by combining isolated functional cells and biodegradable scaffolds made from engineered biomaterials. Multidisciplinary teams of scientists are working on design and fabricate the suitable scaffolds, on solving cell related issues and investigate the engineering of tissue construct in vitro and invivo. Nanostructured Bioglass (NBG) possesses excellent bioactivity and cell compatibility, and is regarded as a promising next-generation biomaterial in the bone-regeneration field. Bioglass coatings are also more resorbable and have higher bone bonding ability than HAP coatings due to their initial physicochemical reaction with the body fluid. However, the formulation of NBG is limited to bulk, crushed powders and micro-scale fibers. Compared to bulk, Nanoscale Bioglass will enhance the osteo-integration to the Extracellular Matrix because of its high surface area and mimicking the size of the bone fundamental units. 45S5 Bioglass (Composition [in wt%]: 45% SiO_2, 24.5% Na_2O, 24.5% CaO, and 6% P_2O_5), was the first man-made inorganic materials engineered to bond to bone tissue which possesses both the property of osteo-conductivity (ie. Enhances the cell proliferation) and osteo-inductivity (i.e. supports the bone formation). These inorganic materials provide an ideal environment for colonization, proliferation, and differentiation of osteoblasts to form new bone exhibiting mechanically strong attachment to the implant surface.

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