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Bioactive Silicon Nitride is a Novel Osteoarthritis Treatment Material

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Description

Although complicated, the reciprocity between bio ceramics and living cells is primarily controlled by the surface chemistry of the implant. Therefore, a greater comprehension of the chemical interactions between bio ceramics and biological tissue may eventually result in new therapeutic approaches. However, it is still unclear what physical and chemical laws control these interactions. The unusual surface chemistry of a relatively novel bio ceramic silicon nitride is examined in this research to explore the complexities of this biological synergy (Si_3N_4).

Building upon prior research, this paper aims at obtaining new insights into the biological interactions between Si_3N_4 and living cells, as a consequence of the off-stoichiometric chemical nature of its surface at the nanometer scale. We show here yet unveiled details of surface chemistry and, based on these new data, formulate a model on how, ultimately, Si_3N_4 influences cellular signal transduction functions and differentiation mechanisms. The Bio ceramics have a long and valued history in orthopedics. Traditionally, aluminas, zirconiaor composites of these compounds were selected because of their bio inertness while others (e.g., hydroxyapatite or bio glass) were chosen because they possessed extraordinary bioactive surfaces. Yet it is now known that all bio ceramics profoundly interact with living tissue at the molecular level even those previously considered to be wholly bio inert. On the one hand their interactions can be detrimental leading to destabilization of the ceramic loss of prosthetic function and reduced lifetime.

On the other hand they may enhance performance increase implant lifetime or even provide protective benefits. Certain bio ceramics can either release or scavenge molecules that support metabolic chemistry and most significantly stimulate cells to replicate and function with exceptional efficiency. We have previously reported about the promising in vitro performance of Si_3N_4 bio ceramics with emphasis on its reciprocity with living cells [1-5]. Studies over the past 40 years have easily shown the bioactivity of silicate glasses and the significance of elemental silicon in bone development. Silicon is immediately absorbed into hydroxyapatite (HAp) by ionic substitution and aids in the formation of glycosaminoglycan's and proteoglycans among other things. Osteoplastic indicators and cell cycle genes were discovered to be effectively controlled by silicic acid (H_4SiO_4), the breakdown product of bioactive glasses. The development of silicon-substituted hydroxyapatites, porous silicon, and silicon/silica nanoparticles all share the Si-enhanced bioactivity mechanism. Nitrogen from amino acids serves as a complimentary ingredient that is necessary for protein synthesis, bone development, and tissue repair. Water, carbon dioxide (CO_2), three inorganic nitrogen compounds - ammonium (NH_4^+), nitrate (NO_3) and di-nitrogen (N_2) - are metabolically assimilated and transformed by cells into complex biomolecules.

One of the more obvious yet surprising features of silicon nitride as a biomaterial is that during biological interactions, H_4SiO_4, NH_4^+, NO_3, and N_2 are all readily and abundantly available. At its inorganic surface, Si_3N_4's unique chemistry, which is chemically modulable promotes a variety of advantageous metabolic interactions between eukaryotic and prokaryotic cells. It was recently discovered that an unusual surface modification of Si_3N_4 with the production of odd Si-Y-Al-O-N phases occurred as a result of a post-sintering annealing cycle in nitrogen.

In back-scattered scanning electron micrographs, these phases, which include N-apatite and other silicates, appeared as whitish patches. The maximum hydroxyapatite production after contact with SaOS-2 cells occurred when Si-Y-Al-O-N phases were present9. Large IGF-1 concentrations verified high levels of cell proliferation and differentiation, but equivalent sRANKL tests revealed a very low tendency to produce osteoclasts.

Conflict of Interest

The authors declare that there is no conflict of interest associated with this manuscript.

References

1. Millard, Alexandra. "Age assessment from cranial suture closure." (2011).
2. Cunha, Eugénia, Eric Baccino, L. Martrille, and F. Ramsthaler, et al. "The problem of aging human remains and living individuals: *Rev. For Sci Inter* 193(2009):1-13.
3. Thabitha, Rani S., Rajendra E. Reddy, M. Manjula and N. Sreelakshmi, et al. "Evaluation of palatal rugae pattern in establishing identification and sex determination in Nalgonda children." *J For Dent Sci* 7(2015):232.
4. Manoharan, C., Dhanalakshmi V, Thangam D, and Edwin Joe. "Estimation of age from human sternum-an autopsy study." *Ind J For Comm Med* 3(2016):128-132.
5. Brooks, Sheilagh Thompson. "Skeletal age at eath: The reliability of cranial and pubic age indicators." *Amer J Phys Anthropol* 13 (1955):567-597.

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