

Bone Tissue Compatibility of Carbon Nanotubes

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Carbon nanotubes (CNTs) have been used in various fields as composites with other substances or alone to develop highly functional materials. CNTs hold great interest with respect to biomaterials, particularly those to be positioned in contact with bone such as prostheses for arthroplasty, plates or screws for fracture fixation, drug delivery systems, and/or scaffolding for bone regeneration. Bone tissue compatibility of CNTs and CNT influence on bone formation accordingly are important issues, but the effects of CNTs on bone have not been delineated. We presently found that multi-walled CNTs adjoining bone induce little local inflammatory reaction, show high bone tissue compatibility, permit bone repair, become integrated into new bone, and accelerate bone formation stimulated by recombinant human bone morphogenetic protein-2.

Then we studied the influence of CNTs to osteoclasts that cause osteolysis and loosening of artificial joints. We show that CNTs inhibit osteoclastic bone resorption in vivo and that CNTs inhibit osteoclastic differentiation and suppressed a transcription factor essential for osteoclastogenesis in vitro.

This study provides an initial investigational basis for use of CNTs in biomaterials used adjacent to bone, including uses to promote bone regeneration. These findings should encourage development of clinical treatment modalities involving CNTs.