Growth factor encapsulation system and method for enhancing bone formation

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Technology description

Summary

Problem or Unmet Need:
Currently, one in every eight Americans is over the age of 65. For this reason, more effective and less invasive therapies targeted to the aging population are needed. Of specific concern is the increased incidence of bone and cartilage fractures in older people. Currently, the standard treatment for bone and cartilage repair is the use of autogenic or allogenic grafts. For an autogenic graft, the patient's own tissue must not only be able to be grafted, but the patient must also endure two painful surgeries. An allograft may transmit viral infections, be rejected by the patient's body, or not be available. Therefore, the need for effective bone repair is needed to combat the problems plaguing our aging society.
Growth factors which can induce osteogenic responses in healing tissue present a less invasive and more reliable bone regeneration and treatment approach. However, this treatment by recombinant growth factors is very expensive. As a less expensive alternative, we have developed a platelet concentration system comprised of platelet-rich plasma (PRP), a concentrated source of growth factors including platelet-derived growth factor (PDGF), transforming growth factor beta (TGF-beta), and vascular endothelial growth factor (VEGF), derived from the patient's own blood to induce bone growth in a surgical site. A significant challenge to this method lies in increasing bioavailability of these growth factors, modulating their release, and altering the kinetics to match the bone regeneration rate.
The technology provides a PRP-encapsulation system that is able to support a multi-staged, prolonged and controlled release of PRP-derived growth factors for bone regeneration. Growth factors are retained inside a biodegradable, biocompatible delivery vehicle which increases PRP bioavailability, provides prolonged therapeutic release necessary for proper bone formation.
This technology further provides a method for facilitating clot formation in PRP with thrombin receptor activator peptide-6 (TRAP-6) rather than thrombin. The use of TRAP-6 results in significantly less clot retraction than thrombin while providing excellent working time for the preparation of PRP.

Application area

The technology comprises a more effective and less invasive method to enhance the formation of bone, which is applicable for oral/maxillofacial surgery, orthopedic surgery, veterinary medicine, and other surgeries necessitating bone growth.

Advantages

The technology incorporates a novel matrix with a biocompatible growth factor system, which offers staged and prolonged release of therapeutic growth factors.
The technology uses TRAP-6 in the preparation of PRP providing a less immunogenic and more economical alternative to thrombin, while minimizing the amount of clot retraction and the potentially rapid loss of critical bone regenerative growth factors at critical stages of the bone healing process.

Institution

Columbia University

Inventors

Helen Lu
Regina Landesberg

联系我们

叶先生

电 话：021-65679356

手 机 : 13414935137
邮 箱 : yeyingsheng@zf-ym.com