Composites for Bone Replacement and Bone Scaffolds

Published date: July 18, 2014

Technology description

The Problem
A large proportion of orthopaedic surgical procedures require bone grafts and with the growing demands there still remains a need to design synthetic bone graft that mimics the structure and composition of bone with good surgical handling properties.
The Solution
The project team has developed a completely synthetic composite which incorporates both bioactive ceramic and polymer components in desired ratios to form a mechanically tough material which actively encourages biomineralisation and cell attachment in body fluid. The ceramic component is a new class of calcium phosphate that does not form poorly resorbable hydroxyapatite.
The material can be easily fabricated repeatedly without complex methods or chemistries with a ‘cage-like’ porosity that absorbs liquid throughout the construct via capillary action, augmented by diffusion of nutrients through the hydrophilic polymer. In-vitro assessment has shown excellent biocompatibility and cellular infiltration and spreading with a variety of cell types.
The composite has been devised to allow rapid translation of this material into all surgical procedures where a bone graft substitute is required. The construct can be easily shaped to defect specifications and implanted into the wound bed absorbing blood and cellular components without significant changes in dimensions, efficiently enhancing remodelling and bone formation. The adhesive nature of the composite allows it to adhere to bone bed or metallic implants if used in conjunction with other devices.
Results from the research to date indicate that the composite bone replacement will have several advantages compared to products available today or in development:

Application area

There is a clinical need for a bone graft substitute that mimics the structure and composition of bone with good surgical handling properties. Approximately 600,000 bone graft procedures are performed in the United States annually, and roughly 2.2 million such procedures are performed worldwide. The global bone graft substitutes market was estimated to be worth $1.9B in 2010 growing to $3.3B in 2017.

Advantages

Mechanical strength equivalent to the bone being replaced in both compression and tension.
Maintenance of the mechanical strength profile in both block form and as an injectable slurry.
Support bone formation whilst retaining the mechanical strength characteristics.
Suitable for large bone defects.
Ability to attract biological factors into the graft that will accelerate bone in growth without having to mix the material with blood and bone marrow and without having to provide the material impregnated with biological factors.
Delivery of the product as an injectable slurry and as formable blocks to fit a wide range of defect sizes and shapes.
The ability to offer a service to produce customised shapes to fit specific defects.
A simple manufacturing method that will allow the product to be manufactured without the need for specialist equipment and at low cost.
The ability to incorporate bone growth stimulating factors into the composite.

Institution

King's College London

Inventors

Evren Kemal
Sanjukta Deb
Senior Lecturer
Biomaterials, Biomimetics & Biophotonics
Clare Gleeson
Dental Institute

联系我们

叶先生

电 话：021-65679356

手 机：13414935137

邮 箱：yeyingsheng@zf-ym.com