ADA Science & Research Institute

Fluorapatite-Forming Calcium Phosphate Cements

ADASRI Case # 10-0001

Inventors

Dr Laurence Chow

Dr Shozo Takagi

Intellectual Property Status:

US Patent Issued: US 8,293,004 B2

Contact

Phil Dowd

Director of Innovation

American Dental Association Science & Research Institute

Email: dowdp@ada.org

Background

Calcium phosphate cements (CPCs) are widely used as bone graft materials, especially in cranial and maxillofacial surgeries, since they are biocompatible and osteoconductive. Over time, the material resorbs and is replaced with bone during the remodeling process. However, in patients where bone regrowth may be slower, such as those with diabetes, smokers, the elderly and those who have undergone radiation in the head or neck, or in applications such as inner ear bone replacement, or in endodontic applications such as root end fill and perforation repair, it is desirable to have CPCs with either low or no bioresorbability in soft and hard tissues.

Invention Description

This invention describes fluoride-containing CPCs, their properties and methods for making such compositions. More particularly, the invention comprises techniques to prepare F-containing CPC materials with controllable amounts of the following desirable minor components and structure: (1) F incorporated in the forms of F-substituted hydroxyapatite (F-HA) and calcium fluoride; (2) Carbonate incorporated into F-HA by replacing a phosphate ion in the structure (type-B carbonate incorporation); and (3) F-containing CPC materials having controllable apatite crystallinity effected by carbonate compounds. The techniques enable design and manufacture of F-CPC compositions having a prescribed range of in vivo resorption rates and osteoconductivity for bone repair. By tailoring the composition, the materials may also be used for dentin desensitization and tooth remineralization.

Potential Applications

The present invention is ideally suited as a bone substitute to improve clinical outcomes for

- Endodontic applications such as root end fill and perforation repair
- Inner ear bone replacement
- Dental implant stabilization
- Patients with reduced bone regrowth rates
- Dentin desensitization and tooth remineralization

Benefits and Advantages

- Materials retain biocompatibility and osteoconductivity of traditional CPCs
- Precise compositional control through a self-setting reaction of fluoride-containing CPCs – allows for tailored resorbability and osteoconductivity
- Highest F-containing composition is non-resorbable & osteoconductive
- Clinically relevant setting times – sufficient to work with and place material while preventing wash-out
- Long shelf-life
- For dentin desensitization – product deposited in dentinal tubules is insoluble in the mouth