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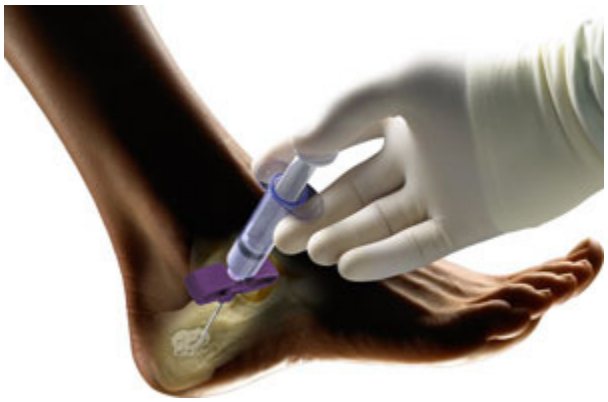
Calcium Phosphate Cement (CPC)



Calcium phosphate cement (CPC) is a synthetic bone graft material that was invented in 1986 by L. C. Chow and W. E. Brown, scientists at the American Dental Association. The cement is a white powder consisting of equimolar amounts of ground Ca4(PO4)2O (tetracalcium phosphate, TTCP) and CaHPO4 (dicalcium phosphate anhydrous, DCPA). When mixed with water, the material forms a workable paste which can be shaped during surgery to fit the contours of a wound. The cement hardens within 20 min allowing rapid closure of the wound. The hardening reaction, which forms nanocrystalline hydroxyapatite (HA) as the product, is isothermic and occurs at physiologic pH so tissue damage does not occur during the setting reaction. CPC was FDA approved for the treatment of non-load-bearing bone defects in 1996.

HA is the primary inorganic component of natural bone which makes the hardened cement biocompatible and osteoconductive. Over time, CPC is gradually resorbed and replaced with new bone. Because CPC is brittle, it is used for non-load-bearing applications such as dental and cranio-facial applications. CPC has two significant advantages over pre-formed, sintered ceramics. First, the CPC paste can be sculpted during surgery to fit the contours of the wound. Second, the nanocrystalline hydroxyapatite structure of the CPC makes it osteoconductive causing it to be gradually resorbed and replaced with new bone. Recent work with CPC has focused on improving mechanical properties, making premixed cements, making the cement macroporous and seeding cells and growth factors into the cement.

References

Invention of CPC: Brown WE, Chow LC (1986) A new calcium phosphate water setting cement. Brown PW, ed. Cements Research Progress. Westerville, OH: American Ceramic Society; 352-379.

CPC Review: Friedman CD, Costantino PD, Takagi S, Chow LC. (1998) BoneSourceTM hydroxyapatite cement: a novel biomaterial for craniofacial skeletal tissue engineering and reconstruction. J Biomed Mater Res (Appl Biomater) 43:428-432, 1998.