Porous Poly Ethet Ether Ketone (PEEK) Biomaterial in Critical Bone Defects

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ABSTRACT

As a new Biomaterial, polyether-ether-ketone (PEEK) has gained widespread acceptance as a high-strength polymer used in hard and soft tissue reconstructions, with favorable imaging compatibility and stiffness that closely matches bone. The ultimate goal of most medical implants is to restore impaired biological function and achieve functional integration with the body. Several porous polymers and other tissue engineered scaffolds have made advances in this regard, however similar solutions in high load-bearing orthopedic environments remain elusive in clinically adopted biomaterials.

The challenge for porous peek material is the engineering of a material with pores that are sufficiently large for bone ingrowth, yet also able to retain desirable structural properties. Porous PEEK implants exhibited increased osseointegration and fixation by improving the migration and proliferation of various cell types to enhance vascular and bone tissue ingrowth.

The findings showed that typical porosity of 51%, Wall Thickness of 312µm, and mean pore size of 369µm demonstrated improvements in connective density near that of trabecular bone, however low compressive strength (15MPa) would preclude the use of wholly porous material in critical size load bearing application.

Limiting porosity to PEEK's surface could promote osseointegration and maintain bulk mechanical properties. A porous surface layer could retain implant strength, provide an optimum external structure for bone ingrowth, and avoid tissue necrosis at the center of large fully porous implants in cases of limited vascular and nutrient supply. Therefore solid- porous PEEK ,will provide both the structural integrity in load bearing application, along with the ability for osseoconductivity and improved implant fixation.