

Fiberglass cranioplasty

A case study describes the properties of an early development stage [bioactive glass](#) containing fiber-reinforced composite calvarial implant with histology that has been in function for two years and three months. The patient is a 33-year old woman with a history of substance abuse, who sustained a severe traumatic brain injury later unsuccessfully treated with an autologous bone flap and a custom-made porous polyethylene implant. She was thereafter treated with developmental stage glass fiber-reinforced composite - bioactive glass implant. After two years and three months, the implant was removed due to an implant site infection. The implant was analyzed histologically, mechanically, and in terms of chemistry and dissolution of bioactive glass. Mechanical integrity of the load bearing fiber-reinforced composite part of the implant was not affected by the in vivo period. Bioactive glass particles demonstrated surface layers of hydroxyapatite like mineral and dissolution, and related increase of pH was considerably less after two and three months period than that for fresh bioactive glass. There was a difference in the histology of the tissues inside the implant areas near to the margin of the implant that absorbed blood during implant installation surgery, showed fibrous tissue with blood vessels, osteoblasts, collagenous fibers with osteoid formation, and tiny clusters of more mature hard tissue. In the center of the implant, where there was less absorbed blood, only fibrous tissue was observed. This finding is in line with the combined positron emission tomography - computed tomography examination with (18F)-fluoride marker, which demonstrated activity of the mineralizing bone by osteoblasts especially at the area near to the margin of the implant 10 months after implantation. Based on these promising reactions found in the bioactive glass containing fiber-reinforced composite implant that has been implanted for two years and three months, calvarial reconstruction with the presented material appears to be a feasible method ¹⁾.

¹⁾

Posti JP, Piitulainen JM, Hupa L, Fagerlund S, Frantzén J, Aitasalo KM, Vuorinen V, Serlo W, Syrjänen S, Vallittu PK. A glass fiber-reinforced composite - bioactive glass cranioplasty implant: A case study of an early development stage implant removed due to a late infection. *J Mech Behav Biomed Mater*. 2015 Nov 7;55:191-200. doi: 10.1016/j.jmbbm.2015.10.030. [Epub ahead of print] PubMed PMID: 26594779.

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