Although octacalcium phosphate (OCP) powder and a collagen/gelatin composite demonstrate good potential as bone substitutes, an OCP block has not been fabricated to date. In this study, the feasibility of fabricating an OCP block was evaluated through a dissolution-precipitation reaction using a calcium sulfate hemihydrate (CSH) block as a precursor. When the block was immersed in a phosphate salt solution, its composition changed to that of OCP, while its structure was maintained. The diametral tensile strength (DTS) of the OCP block was 1.0 ±0.2 MPa. The macroporosity and microporosity of the OCP block were 33.4 ±4.5% and, 69.0 ±1.6%, respectively. New bone attached well to the OCP block, and this block was partially replaced by bone 2 weeks after implantation. Four weeks after implantation, the surface of the OCP block was nearly covered with new bone and ~30% of the block was replaced by new bone, while no replacement by bone was observed in the case of a hydroxyapatite (HAp) block used as a control. It is concluded that OCP blocks are potentially suitable for their use as artificial bone substitutes.