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STUDY OF BIOACTIVE GLASS IN MICROGRAVITY

Abstract

Spaceflight osteopenia (characteristic bone loss that occurs during spaceflight) is a huge concern to the health of astronauts. Astronauts lose an average of more than 1 percent bone mass per month spent in space. There is concern that during long-duration flights, excessive bone loss and the associated increase in serum calcium ion levels will interfere with execution of mission tasks and result in irreversible skeletal damage. This paper aims to find a solution to osteopenia by using bioactive glass. An understanding of the fundamental changes that occur to bone cells with bioactive glass in microgravity conditions would yield important information in treating osteopenia. The bioactive glass particles undergo conversion to hydroxyapatite (HA) due to hydration. Osteoblasts start forming new bone on and in between the glass. Tissue bonds begin to form with the soft collagen tissue present and the new bone being formed. Osteoclasts remodel the bone and leave behind fully functional bone without any of the former glass particles remaining. Using bioreactors and bone-bioactive glass as the microcarrier, we observe the growth of three-dimensional bone like structure. The overall design of the bioreactor, the theoretical transformations of bioactive glass under microgravity conditions, the possible ways of manufacturing bioactive glass in space will be described in the paper along with the theoretical ways it could be used on astronauts.