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IN VITRO BIOCOMPATIBILITY OF NEW BIOACTIVE LITHIA-SILICA GLASS-CERAMICS

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ABSTRACT

Glass-ceramics based on the $\text{Li}_2\text{O-SiO}_2$ system have been extensively used as restorative dental materials due to their excellent chemical durability, aesthetics, inertness in the buccal environment, and high fracture strength; but they are not bioactive. On the other hand, all known bioactive glasses show ability to bond to bone, teeth and cartilage coupled to osteoconduction and osteoinduction, but their fracture strength and toughness are rather low. The aim of this study is to develop and evaluate the in vitro biocompatibility of a new type of (bioactive and strong) lithia-silica glass-ceramic. For these purposes, two types of glass-ceramics based on a multicomponent lithia-silica system were studied: lithium metasilicate (LM) and lithium disilicate (LD). The in vitro bioactivity study was conducted in a SBF solution, before and after different times of immersion; the new materials were analyzed by XRD, FTIR, and SEM. Some samples were subjected to in vitro biodegradation tests to quantify the release of lithium and the weight loss. Cytotoxicity, adhesion, and cell proliferation on different samples were examined by using the Methyl Tetrazolium salt (MTS) and Alizarin Red. For ~ 40%vol. crystallinity, lithium metasilicate was detected as the major phase, whereas for ~ 80%vol. crystallinity, lithium disilicate was the major phase. The LD proved to be strong (3p-bending strength of 233 ± 12 MPa) and bioactive after 14 days of immersion in SBF. In terms of lithium ion release, the LD was outside the toxic range (> 8.3 ppm). The LM and LD are not cytotoxic. The LD shows the best cellular adhesion and proliferation, leading to the formation of a mineralized matrix after 21 days. These results clearly

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