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Exploring the toxicity and biocompatibility of recent advances in biomaterials for Dentistry and Maxillofacial surgery

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The growing interest in using biomaterials for tissue engineering in recent years is largely due to their potential in Dentistry and Maxillofacial Surgery. One such material, hydroxyapatite, is often used for bone reconstruction because its chemical structure is similar to that of human bone. A particularly promising source of hydroxyapatite is Fish Scale-Derived Hydroxyapatite (FSHA), which is rich in calcium phosphate and has been shown to support cellular growth and attachment, indicating its biocompatibility.

Maintaining the shape and structure of the alveolar ridge after a tooth extraction is crucial for successful implant placement and prosthetic rehabilitation. To address this, researchers have developed 3D-printed bone scaffolds using various biomaterials, such as polylactic acid (PLA) and FSHA, to enhance their bone regeneration potential. This technology allows for precise customization and increased patient-specificity, making it a promising option for socket preservation and alveolar ridge maintenance. With this background, this study aims to evaluate the toxicity and bone regeneration potential of FSHA in both in vitro and in vivo murine models, as well as to develop and assess the biocompatibility of 3D printed scaffolds made from PLA and FSHA.

The in vitro study showed that FSHA is biocompatible, and in vivo studies showed statistically significant new bone production, suggesting that it has regenerative potential. Furthermore, the 3D-printed PLA-FSHA scaffolds displayed compressive strength comparable to that of human cancellous bone. The estimated average pore size of the scaffold was 572±33 µm, which is suitable for angiogenesis, cell migration, and proliferation. The biocompatibility of the PLA-FSHA scaffolds was also confirmed through in vitro and in vivo testing in accordance with ISO10993-4/5/6, including tests for hemocompatibility, cytotoxicity, and histological analysis. Based on the results of this study, it can be concluded that FSHA, due to its good osteoconductive properties, can be used as a promising option for socket preservation in various forms in dentistry and maxillofacial surgical applications.

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