LONGDOM CONFERENCES

5th International conference on
Stem Cell, Tissue Engineering and Regenerative Medicine
14th International Conference on Dental and Oral Health
24th World Congress on Nursing Care and Healthcare
May 18-19, 2023 | Rome, Italy

Poster Presntation

Highly porous demineralized collagen matrices combined with low-temperature calcium phosphates

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The development of osteoplastic materials with a high potential for osseointegration capable of providing a complete and effective regeneration of bone tissue still remains an urgent and unresolved issue in modern tissue engineering. To create optimal conditions for bone tissue regeneration, there is a great need for porous, biocompatible and stimulating localized osteogenesis materials that can provide effective recovery of bone tissue structure and volume with complete regeneration of bone integrity as an organ, and preferably within a short time frame. Currently, in traumatology, orthopedics and dentistry, using the technology of reconstructive bone tissue surgery, the most popular materials are bone grafts and bioartificial synthetic calcium phosphate materials. The presented work proposes an approach to create composite bioinspired osteoplastic materials for reconstructive bone tissue surgery by deposition (remineralization) on the surface of high-purity bone-collagen demineralized calcium phosphate matrices under conditions simulating the natural process of bone tissue biomineralization. The combination of demineralized bone matrix (DBM) as a scaffold and low-temperature hydroxyapatite (Hap) precursors as a coating can lead to the most effective osteoplastic material. Demineralized bone matrix (DBM) was obtained according to the author's method (patent RU 2686309 C1, 04.25.2019). Deposition of the calcium phosphate coatings on the matrix was carried out by precipitation of dicalcium phosphate (DCPD) in acetate-based solutions followed by transformation to octacalcium phosphate (OCP).

The methods of histological and elemental analysis show reproduction of bone tissue matrix microarchitectonics and a high purity degree of the obtained collagen matrices; the methods of cell culture and confocal microscopy show high biocompatibility of the materials obtained. In the model of heterotopic implantation in rats for a period of 7 and 11 weeks, intensive intratrabecular infiltration of precipitated calcium phosphates into the structure of bone-collagen matrices by the type of full physiological biomineralization was demonstrated, as well as a pronounced synthetic activity of osteoblasts that remodel and rearrange implanted materials without any signs of utilization resorption. Computed tomography and scanning electron microscopy of DBM-OCP sample presented on the Image.

Biography: Polina Smirnova (maiden name Polina Mikheeva till 2021) has experience in the field of obtaining biocompatible materials for bone tissue engineering, chemical synthesis of bioactive coatings and materials, including low-temperature methods. She has considerable experience in investigations and processing of visualization data obtained using electron microscopy, X-ray diffraction, IR-spectroscopy and computed tomography methods

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Received: 28-Nov-2022 , Accepted : 30-Nov-2022 Published: 06-Jun-2023