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Histomorphological acceptance of synthetic hydroxyapatite granules by soft tissue of alveolar ridge

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Granules of synthetic porous hydroxyapatite (HA) manufactured in Laboratory of Biomaterials, Riga Technical University since 1995 were used in experimental and clinical implantations on the alveolar ridge as part of preprosthetic surgery to improve the sites for dental implants.

There were subperiosteal implantations in 6 dogs, 15 rabbits and 176 patients. In experimental part the samples for histomorphological evaluation using staining by hematoxyline – eosine and method of van Gieson were taken out for two weeks, and one, three and four months after implantation. In clinical cases, full thickness gingival tissue taken out at the second stage surgery on an average after three months in mandible and six months in maxilla to put in or to open osseointegrated dental implants were investigated by the same histological and immunohistochemical reactions with an anti-actin and anticollagen type VI monoclonal antibodies. In evaluation of stained samples, besides the traditional eye-controlled microscopy, the computer-based technology by means of Leica Quantimed Q500MCP and Pentium 3 – 700 MHz computer equipped with Image – Pro Plus software was used.

Early postoperative clinical signs were the same as after another operation on alveolar ridge with elevation in mucoperiosteal layer. Late results were dependent on the tissue layer where granules were put in. Submucosal migration of granules resulted in clinical signs of perigranular inflammation and extrusion of granules themselves or by incision. All granules in subperiosteal layer integrated well and the full desired clinical outcome was achieved. There were some technical difficulties to drill through very dense HA and bone composite for insertion of dental implants later as 6 months after the first stage of augmentation. Histologically after two weeks there were newly formed fibrovascular tissues with fibrin, macrophages and thin collagen fibers around granules. In later period the reduction of inflammatory cells and vascularity with increasing of collagen fibers was observed. By the six-month period there was moderate hyperplasia, acantosis and keratinisation in the epithelial layer; sclerosis of connective tissue and homogenisation of collagen fibers. There were also small nids of chronic productive inflammation and few giant cells around the HA granules in subepithelial level.

In clinical cases after three years there was only some hyperplasia in epithelial layer; homogenisation of collagen fibers, hiperelastosis in wall of microvesels, small residual granules of HA without any inflammation around in subepithelial layer. Immunohistochemical tests showed few immunoreactive nerve fibres in the outer layer of periosteum, around the secretory parts of small salivary glands and in the wall of blood vessels 3 and 4 months after implantation.

Our results confirmed good biocompatibility and slow biodegradation of HA granules in soft tissue of alveolar ridge and increasing use in preprosthetic oral surgery.