

TRANSFORMING GROWTH FACTOR β (TGF β) IN CONTACT TISSUE TO SYNTHETIC HYDROXYAPATITE (HAp) IMPLANTS

Ilze Salma, Mara Pilmane¹, Janis Vetra¹,
Andrejs Skagers, Rita Serzane²

¹ Riga Stradins university, Department of Oral and Maxillofacial Surgery,
Institute of Anatomy and Anthropology,

² Riga Biomaterials Innovation and Development Center,
Riga Technical University Latvia

TGF β family exerting influence on differentiation and activation of bone cell progenitors, osteoblasts as well osteoclasts plays an important role in the balance between resorption and subsequent bone formation during growth, regeneration and remodeling of bone .

The aim of the study was to evaluate expression of TGF β in contact tissue to synthetic HAp after intraosseal and subperiosteal implantation.

Material and methods. Porous HAp ceramic implants were produced in Riga Technical University Biomaterials R&D Laboratory. The porosity of obtained ceramics was 25% – 30 %, water uptake 10 – 13% from mass and volume mass 2.1 – 2.2 g/cm³. Quality of the HAp powder and ceramic were estimated by IR spectro-scopy and X-ray diffraction.

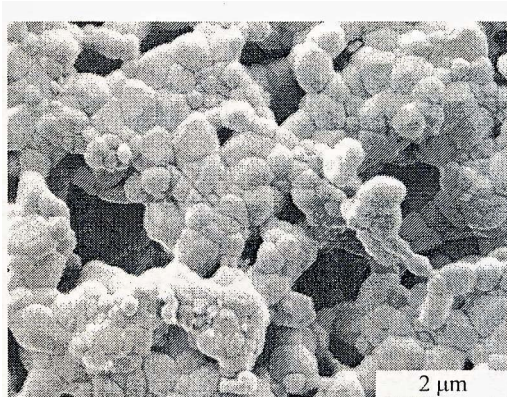


Fig. Scanning electronmicroscopy of implanted HAp cylinders

With permission from Animal Ethics Committee of Latvian Food and Veterinary Administration experimental operations on 26 New Zealand male rabbits were done. Local anesthesia with Sol. Lidocaini 2% (4 mg/kg) as well general anesthesia with Ketamin 15 mg/kg un Midazolam 0.5 mg/kg was performed. On 14 animals halfcylinders of HAp ceramic were inserted intraosally in edentulous part of upper jaw, on 12 animals subperiosteally in region of lower jaw angle. The same surgery approach without implantation of HAp as control was done on opposite side.

The samples of bone and contacting soft tissue were taken out after two weeks and three months. Sections done with EXACT Grinding system and from paraffin blocks were stained with hematoxylin/eosin and using biotin and streptavidin immunohisto-chemical method on expression of TGF β (1279, 1: 1000, Cambridge Science Park, UK).

Results. Two weeks after intraosseal implantation TGF β was same intensively expressed in endosteum of both side sections, but in bone around HA implants expression of TGF β was in moderate up to marked number of bone cells while in control side was no expression. Expression of TGF β in contact soft tissue was small in experimental side and no in control side. After subperiosteal implantation of Hap ceramics as tablets in two weeks was no expression of TGF β either in bone or soft tissue, but after three months was rich expression in both bone and periosteum.

Conclusion. Distinct higher expression of TGF β in osteocytes of bone and cells of periosteum surrounding intraosally and subperiosteally inserted porous HAp ceramic implants may confirm osseoinductive activity of synthetic HAp through activation of endogenous growth factors.

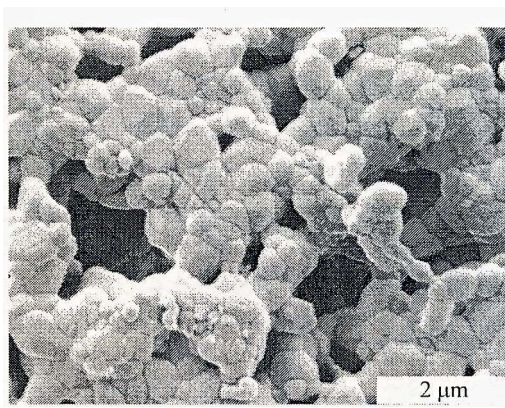


Fig. Scanning electronmicroscopy of implanted HAp cylinders

With permission from Animal Ethics Committee of Latvian Food and Veterinary Administration experimental operations on 26 New Zealand male rabbits were done. Local anesthesia with Sol. Lidocaini 2% (4 mg/kg) as well general anesthesia with Ketamin 15 mg/kg un Midazolam 0.5 mg/kg was performed. On 14 animals halfcylinders of HAp ceramic were inserted intraosally in edentulous part of upper jaw, on 12 animals subperiostally in region of lower jaw angle. The same surgery approach without implantation of HAp as control was done on opposite side.

The samples of bone and contacting soft tissue were taken out after two weeks and three months. Sections done with EXACT Grinding system and from paraffin blocks were stained with hematoxylin/eosin and using biotin and streptavidin immunohisto-chemical method on expression of TGF β (1279, 1: 1000, Cambridge Science Park, UK).

Results. Two weeks after intraosial implantation TGF β was same intensively expressed in endosteum of both side sections, but in bone around HA implants expression of TGF β was in moderate up to marked number of bone cells while in control side was no expression. Expression of TGF β in contact soft tissue was small in experimental side and no in control side. After subperiostal implantation of Hap ceramics as tablets in two weeks was no expression of TGF β either in bone or soft tissue, but after three months was rich expression in both bone and periosteum.

Conclusion. Distinct higher expression of TGF β in osteocytes of bone and cells of periosteum surrounding intraosally and subperiostally inserted porous HAp ceramic implants may confirm osseoinductive activity of synthetic HAp through activation of endogenous growth factors.

CALCIUM PHOSPHATES FOR CLINICAL APPLICATION WITH VARIABLE PHASE COMPOSITION: SYNTHESIS AND CHARACTERIZATION

**Kristine Salma, Liga Berzina-Cimdina, Natalija Borodajenko,
Zilgma Irbe, Liene Plūduma**

Riga Biomaterials Innovation and Development Centre,
Riga Technical University, Latvia

Hydroxyapatite (Hap) and β -tricalcium phosphate (β -TCP) represent the main types of calcium phosphates used in maxillofacial surgery. Hap is thermodynamically the most stable phase in physiological conditions and has the ability to form direct chemical bonding with living tissues while β -TCP is a resorbable material and stimulates new bone formation. Biphasic calcium phosphates (BCP) were developed to combine the high bioactivity of Hap and bioresorbability of β -TCP. These properties can be controlled by varying Hap/ β -TCP ratio.