Hydroxyapatite suitability for rat and rabbit implantation

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Given the differences of laboratory animals size and metabolism, to evaluate properly in vivo hydroxyapatite (HA) based implants, the latter must suit and fit appropriately the model to recover the most from it during specimen analyses.

Two types of HA based implants were evaluated, one consisting of a macroporous HA:β-TCP (MHA) processed by direct consolidation using the protein-action technique, a globular protein based consolidation with ovalbumin, and one HA nanopowder with addition of Mg2+ 0,36%wt (NHA) synthesized by neutralization method, inside an ultrasound bath. The MHA sample shape to implant in the animal model was obtained cutting the consolidated material with a core-drill of 4mm in diameter, the NHA was used as powder. For in vivo test rats Wistar and rabbits NZ white were available. The implant surgery were performed under deep anesthesia with pharmacologic association of xylazine/ketamine 5mg/kg-35mg/kg respectively for rats and xylazine/pentobarbital 1mg/kg-20mg/kg respectively for rabbits, the osseous defect were performed with a driller of 2mm in rat's femur and 4mm in rabbit's tibia, post surgery a pentantibiotic 0,2mL/animal prophylactic and morphine 10mg/kg analgesic were injected. Rats were evaluated after 4 weeks and rabbits after 8 weeks.

Porous scaffolds such as MHA, has limitations concerning the size of the sample, as increased fragility in small sizes, making the adjustment to cut a sample in 2mm diameter very difficult and unpromising. Although 2mm bone defect limit in cross section of rat's femur is the reasonable limit to test implants properly. On the other hand rabbit's tibia has a much wider area to perform a bone defect, nevertheless in large implant sites, particulate materials are difficult to not collapse in bone defects bigger than 2mm. The 2mm defect of rat's femur was suitable to hold the powder compacted in situ, besides its higher metabolism which lead to a half repair time compared to rabbit's also showed some particles of HA, inside the repaired bone in process of remodeling. Furthermore during the bone repair of MHA in rabbits could be observed bone ingrowth inside the pores towards the center of the implant.

Due the small size and faster metabolism rats are best fit to test implants of nanopowder while rabbits for having larger long bones and slower metabolism are best fit to evaluate macroporous implants. Hence the laboratory animal choice should fit the implant sample by its features not the opposite