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Long-term implantation of zinc containing hydroxyapatite microspheres in rabbit tibia

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Abstract – Synthetic hydroxyapatite (HA) is the most promising bioceramic material used as bone substitute because of its similarity in chemical structure to that of the inorganic matrix of the living bone and teeth. Previous studies have been shown that the addition of zinc to hydroxyapatite (ZnHA) promotes stimulatory effects on bone formation *in vitro* and *in vivo* and inhibitory effect on osteoclastic bone resorption *in vitro*. Various studies have been shown different shapes of HA (particles, cylinders, spheres). The objective of this study was to evaluate *in vivo* the bone repair and biocompatibility of hydroxyapatite and zinc-apatite 0,5% microspheres in bone defects in rabbit tibia in periods of 12, 26, 56 and 78 weeks. It was evidenced a greater bone formation with absence of inflammatory response to ZnHA microspheres group in all periods when compared to HA group.

Hydroxyapatite is widely used as bone substitute because of its biocompatibility, bioactivity, osteoconduction properties and similarities to the inorganic portion of bone tissue [1, 2]. The presence of trace elements (Zn) affects the bone formation and resorption through direct or indirect effects on bone cells, being able to increase the mineralization both *in vivo* and *in vitro*, as this related to the production of collagen matrix of bone[3,4]. The present biomedical scenario sees the increased use of hydroxyapatite in different shapes and sizes for various applications [5]. Sphericals forms have received much attention due to their specific applications and evaluation. The spherical shape is suitable for assessing the biocompatibility of materials, according to their uniformity, surface area regular, no edges or angles that serve as pro-inflammatory agents. The objective of this study was to evaluate *in vivo* the repair capacity and biocompatibility of hydroxyapatite and zinc containing hydroxyapatite in bone defects of rabbit tibia. Microspheres were produced and characterized with size of 425µm< ϕ <500 µm for implantation in 24 New Zealand White rabbits. After general anesthesia, anti-sepsis and bone exposure, one perforation (2mm) was made in each tibia for implantation of ZnHA (left) and HA (right). After 12, 26, 52 and 78 weeks the rabbits were killed and the implanted bone blocks removed, fixed in alcohol and processed for embedding in resin, with slices of 50µm thick for analysis in scanning electron microscopy and transmission. It was concluded that the materials are biocompatible, osteoconductive and promote local osteogenesis. The addition of 0.5% zinc to hydroxyapatite accelerated the osteogenesis and stimulated the bone formation.

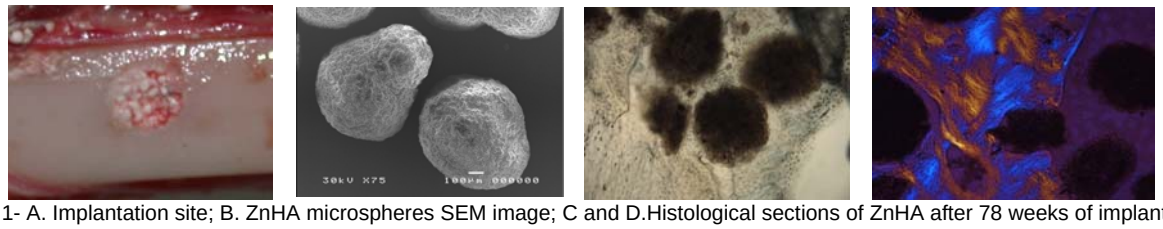

Fig. 1- A. Implantation site; B. ZnHA microspheres SEM image; C and D.Histological sections of ZnHA after 78 weeks of implantation.

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