IJAE
Vol. 117, n. 2 (Supplement): 45, 2012
ITALIAN JOURNAL OF ANATOMY AND EMBRYOLOGY

In vivo biodegradation of a new PVP-Hydrogel

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The target applications of the hydrogel biomaterials are the "difficult wounds", that is the wounds caused by burns, abrasions and ulcerations, by vascular or endocrine disorders (diabetes). This study describes the in vivo biodegradation process of a new biomaterial (PVP-Hydrogel), comparing it with a haemostatic biomaterial (Matemo) which had showed a complete biodegradation process in previous experiments. The new hydrogel consists of three biocompatible polymers: Polyvinyl pyrrolidone (PVP), Agar and Polyethylene glycol (PEG), at first mixed and then sterilized by gamma irradiation at 25 kGy.

For the experimental protocol, the dorsal skin of a rat was incised creating two pouches in its subcutaneous tissue so as to introduce a specimen (1 cm2 of size) of Matemo on the left side, and of PVP-Hydrogel on the right side. The intervention was repeated on 6 different rats, while other 3 were used as controls. Of all treated animals, some were sacrificed after 45 days and some others after 90 days from the operation. Subsequently, the dorsal skin of each animal was inspected on both implant sides, taking skin and subcutaneous tissue fragments for histological studies.

The microscopic analysis of the implant area fully confirmed the macroscopic analysis: the implanted PVP-Hydrogel still appeared in situ and almost intact, not at all biodegraded but anchored to the dermal layer and to the muscular fascia. At the end of the prefixed deadlines of the experiment, that is at the 45th and the 90th day post-implant, the biomaterial had kept intact without any sign of biodegradation, while on the left side the Matemo had been completely reabsorbed. The connective tissue, in which the hydrogel was enclosed, appeared like a thin capsule, proliferating and isolating the biomaterial with a minimum attraction of macrophages in the wall.

Therefore, it is impossible to document a biodegradation process of the hydrogel in vivo, but on the contrary it is possible to confirm the very long persistence of the biomaterial in situ showing no sign at all of inflammation.

The results of this in vivo study show that this new hydrogel could be used in humans for the applications listed above, because it just kept intact in the body for a very long time without causing adverse histological reactions.

Keywords: PVP-Hydrogel, biomaterials, difficult wounds, biodegradation.