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Biocompatibility assessment of different origin Barrier Membranes for Guided Bone Regeneration

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Abstract : Introduction: Biocompatibility of biomaterials has been proposed as one of the main criteria for treatment success. For guided bone regeneration (GBR), barrier membranes present a conflict given the number of origins and modifications of these materials. The biologic response to biomaterials is orchestrated by a series of events leading to the integration or rejection of the biomaterial, posing questions such as if a longer occlusive property may trigger an inflammatory reaction. Whole blood cultures are a solution to study the immune response to drugs or biomaterials during the first 24-48 hours. The aim of this study is to determine the early immune response of different origins and chemical modifications of barrier membranes. Materials & Methods: 5 different widely used barrier membranes were included in this study: Acellular dermal matrix (AlloDerm, LifeCell®), Porcine Peritoneum (BioGide, Geistlich Pharma®), Porcine Pericardium (Jason, Botiss Biomaterials GmbH®), Porcine Cross-linked collagen (Ossix Plus, Datum Dental®) and d-PTFE (Cytoplast TXT, Osteogenics Biomedical®). Blood samples were extracted from 3 different healthy donors and incubated with the different samples of barrier membranes for 24 hours. After the incubation time, serum samples were obtained and analyzed by means of biocompatibility assays taking into account 42 markers. Results: In an early stage of the inflammatory response, the Acellular dermal matrix, porcine peritoneum and porcine cross-linked collagen expressed similar patterns of cytokine expression with a great manifestation of ENA 78. Porcine pericardium and d-PTFE presented similar cytokine activation, especially for MMP-3 and MMP-9, although other cytokines were highlighted with lower expression. For the later immune response, Porcine peritoneum and acellular dermal matrix MCP-1 and IL-15 were evident. Porcine pericardium, porcine cross-linked collagen and d-PTFE presented a high expression of IL-16 and lower manifestation of other cytokines. Different behaviors depending on an earlier or later stage of the inflammation process were observed. Barrier membrane inflammatory expression does not only differ depending on the origin, variables such as treatment of the collagen and polymers may also have a great impact on the cytokine expression of the studied barrier membranes during inflammation. Conclusions: Surface treatment and modifications might affect the biocompatibility of the membranes, as different cytokine expressions were evidently depending on the origin of the biomaterial. This study is only a brushstroke regarding the biocompatibility of materials, as it is one of the pioneer studies for ex vivo barrier membranes assays. Studies regarding surface modification are needed in order to clarify mystifications of barrier membrane science.

Keywords : biomaterials, bone regeneration, biocompatibility, inflammation
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