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SELECTION OF A HUMAN BONE AS A SCAFFOLD FOR ISLET ENCAPSULATION IN A 3-DIMENSIONAL DEVICE

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Background: Islets encapsulation in a monolayer cellular device (2D-encapsulation on a human acellular collagen matrix) can correct diabetes up to 8 months in a pig-to-primate pre-clinical model without immunosuppression. The aim of this study is to develop a 3D-encapsulation system using a human bone scaffold to improve graft survival and function by a better nutrients/oxygen supply and an increased yield of islets loaded per volume of implant.
Materials: Human cancellous bones from different sites (talus, femoral head, calcaneus, condyle, tibial plateau, greater trochanter) were tested. After decellularization, tissues were cut into small pieces (1 cm^2*4 mm), demineralized and scanned by microtomography to analyze pore size distribution, open/close porosity. These structural results were correlated with the human islet size distribution obtained from 24 post-purification preparations (50–99, 100–149, 150–199, 200–249, 250–299, 300–349, 350–399, 400–500 μm).
Results: The close porosity was nearly inexistent in the selected bones (mean: 0.015% of the total bone volume). All bone types were able to receive smallest human pancreatic islets (50–349 μm) which represent 83% of the total volume, but, after statistical analysis, only calcaneus and tibial plateau demonstrated a suitable pore size distribution able to accept islets with a diameter >350 μm (17% of the total volume). The tibial plateau was avoided due to a higher inter-donors variability and lower bone matrix, resulting in hyperconnectivity between pores and then leading to lost of islet during the cellular seeding on the scaffold. The calcaneus was the most adapted bone to load the largest volume of islets (+12.5% compared to other samples).
Conclusion: From theses theoretical results, the calcaneus was selected as the best scaffold for islet encapsulation in a new tridimensional device. The human islet viability and function must be now compared *in vitro* and *in vivo* for a 2D versus a 3D scaffold.