ABSTRACT

INTRODUCTION

Well-known fact, that except for young, immature skeleton the articular hyaline cartilage has only very limited capacity to repair. Focal cartilage defect if not treated in time may lead to advanced osteoarthritis, therefore, it represents major challenge for orthopaedic surgeons and tissue engineers. The currently practiced techniques repair cartilage defect by delivering either cells (bone marrow stimulation) periosteal flapping, autologous chondrocyte implantation (ACI), or readily formed cartilage tissue (osteochondral auto/allografting) to the defect site. Many drawbacks are known for these surgical solutions. One of the greatest concerns about cell-based therapies is the produced fibrocartilage, or hyaline-like cartilage, which is of some lower quality when compared to the adjacent original hyaline cartilage. When delivering readily formed cartilage tissue with osteochondral grafts, the subchondral bone has to be compromised as these grafts deliver cartilage along with its bony base. To avoid this problem, it may seem rational to transplant pure cartilage tissue to the defect site without any osseal support.

METHODS

Porcine knee joints were collected from freshly slaughtered animals and joints were opened under sterile circumstances. A 2x1 cm rectangular area of the weight-bearing surface of the medial femoral condyle has been prepared for chondral graft harvest. Cartilage specimens collected with the cartilage harvester (discussed above) were kept refrigerated in PBS (4°C- leaving all cells alive), and used within 72 hours. Before implantation the deep side (formerly osseal surface) of the graft has been incised using a specially designed device (incisor). Incisions were made every 200 µm converting the specimen into an easily pliable graft. According to our calculation the deep zone surface area of the graft can easily become 20-times larger following the augmentation process (even more depending on both the depth of the incisions and the number of directions the incisions are carried out- unidirectional or crossing cuts).

Nineteen-month-old meat type pigs were selected. All pig weighed between 105-120 kg prior to surgery. All animals were operated under general anaesthesia using standard sterile isolation protocols. The medial femoral condyle and the trochlea was approached by arthrotophony approach. Minimally 1-2 cm2-sized full thickness cartilage defects were created on the weight-bearing surface. The porcine knee joint is fairly thick, in respect to the size of the femoral condyle and the cartilage thickness (an often underappreciated advantage) increasing the human relevance of this animal model. Contralateral legs were not operated to serve as normal internal controls and to allow the animals to walk easier in the postoperative period. All animal care and experiments were carried out in accordance with our institution’s guidelines, and with the regional animal study ethical committee’s recommendations.

DISCUSSION

The applied cartilage surface processing method allows good osteochondral integration and the repair tissue appears to have good macroscopic and histological characteristics. If further studies confirm the efficacy of this technique it could be considered for human application in the future.

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