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In vitro study on a tissue engineered osteochondral composite

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**Purpose:** The purpose of this work is to create an in vitro model of engineered osteochondral composite by combining a cylinder of calcium phosphate and cartilage tissue produced by isolated swine articular chondrocytes seeded onto fibrin glue.

**Methods and Materials:** Swine articular chondrocytes were enzymatically isolated and seeded onto fibrin glue. Immediately before gel polymerization, the fibrin glue was placed in contact with the cylinders of calcium phosphatescaffold. The osteochondral composites were left in standard culture conditions and retrieved after 1 and 5 weeks. At the end of the experimental times, the samples were macroscopically analyzed and processed for histological, immunohistochemical, biochemical and biomechanical evaluation.

**Results:** Preliminary data showed a macroscopically integrity of the osteochondral samples. Histology showed cartilage like tissue maturing within the fibrin glue scaffold. Moreover, GAGs seemed to penetrate microscopically into the scaffold, determining an interface area of microscopic integration between the porous of the scaffold and the cellular fibrin glue. Biochemical analysis confirmed the presence of vital cells, dipped into the GAG matrix. Immunohistochemical analysis demonstrated the presence of type II collagen fibers.

**Conclusions:** The results of this study demonstrate that isolated chondrocytes, seeded onto fibrin glue, produce a cartilage-like matrix that integrates with a cylinder of calcium phosphate. Moreover, we noticed a microscopic penetration of the newly synthesized GAGs inside the structure of the calcium phosphate, confirming the importance of an in vitro maturation of the engineered tissue. This tissue engineered osteochondral composite could represent a valuable model for further in vivo studies on the repair of osteochondral lesions.

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Soaking versus moist storage of autologous patellar tendon before implantation for anterior cruciate ligament reconstruction: a biomechanical study

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**Purpose:** The effect of different intraoperative storage methods on the bone-patellar tendon-bone graft for ACL reconstruction is not known. We compared tendon weight and pull-through force with two intraoperative graft storage methods.

**Methods and Materials:** Patellar tendons were harvested from eight matched pairs of cadaveric knees. The central 10 mm of the patellar tendon was excised to create standard grafts. For each pair, one graft was randomly assigned to be stored immersed in normal saline and the other was stored in moist gauze. Weight and bone tunnel pull-through force were compared between 0 and 5, 0 and 20, and 5 and 20 minutes. Statistical significance was set at p < 0.05.

**Results:** Graft weight in the soaked group at 5, 0 and 20 minutes was 3.5 g, 6.6 g, and 5.8 g, respectively. Weight at 0 versus 5, 0 versus 20, and 5 versus 20 minutes was significantly different in the soaked group (p < 0.01) but not in the gauze group. Pull-through force in both groups was significantly different at 0 versus 5, 0 versus 20, and 5 versus 20 minutes. The percentage increase in weight and pull-through force of the soaked grafts was significantly higher than the increase in the grafts stored in moist gauze at all intervals measured (p = 0.001).

**Conclusions:** This cadaver study suggests that intraoperative storage of grafts in moist gauze leads to less swelling and weight gain as compared with soaking in saline.

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Arthroscopic Techniques for the Fixation of a three dimensional Scaffold for Autologous Chondrocyte Transplantation: Structural properties in an in vitro model

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**Purpose:** Aim of the present study was to evaluate the structural properties of m-ACL during arthroscopic fixation using a transosseous suturing technique and a technique using biodegradable pin devices.

**Methods and Materials:** We evaluated the ultimate failure load, yield load and stiffness of three different techniques for the fixation of a 2 mm thick polymer fleece: 1. Fixation with biodegradable PLLA Pins, 2. a transosseous anchoring technique, and 3. conventional suture fixation. Technique 1 (pin) and 2 (transosseous anchoring) can be used arthroscopically.

**Results:** Yield load and maximum load of both and stiffness were significantly higher in the group 1 (pin fixation) and group 2 (transosseous anchoring) compared to group 3 (conventional suture). Stiffness was significantly higher in group 1 than in group 2 or 3.

**Conclusions:** The initial fixation strength of techniques that can be used for the arthroscopic fixation of scaffolds for autologous chondrocyte transplantation is superior to that of conventional suture fixation. The biomechanical data about the fixation strength of arthroscopic techniques for the fixation of three dimensional scaffolds for autologous chondrocyte transplantation justify further research about these techniques.

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Load-dependent healing of rabbit knee osteochondral defects

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**Purpose:** In experimental studies the natural healing response of an osteochondral defect has been shown to be load-dependent. We decided to evaluate the healing response of defects created in the anterior aspect of the femoral condyle with that of defects in the posterior aspect.

**Methods and Materials:** Six 4-month-old New Zealand White rabbits were used. With the knee maximally flexed, a full-thickness defect (3x3mm) through the articular cartilage and into the subchondral bone was prepared on the center of the condyle, 1.5 mm above the medial meniscus. A posterior defect was created in the center of the medial femoral condyles of the remaining six knees through a longitudinal incision in the semi-flexed knee.

**Results:** Twelve weeks after surgery, the typical healing response of an anterior (non weight-bearing) defect presented fibrocartilaginous tissue. The formation of hyaline cartilage was the most distinct feature of the posterior defects as compared with the anterior. Overall, the histological score of the anterior defects was 12.6 ± 1.3 and in the posterior defects 18.7 ± 4.0.

**Conclusions:** Our findings of a consistent difference in the healing response dependent on the location of the defect is in agreement with previous data. The mature hyaline cartilage that was found in the posterior defects provides a platform where emphasis could be put on the integration issue. Based on our results, we consider the study of healing posterior defects should be considered where there is an aim to use rabbit experiments to mimic the weight-bearing situation in human knees.