Treatment of defects in joint cartilage aims to re-establish normal joint function. In vitro experiments have shown that the application of synthetic scaffolds is a promising alternative to existing therapeutic options. A sheep study was conducted to test the suitability of microporous pure $\beta$-tricalcium phosphate (TCP) ceramics as tissue engineering scaffolds for the repair of osteochondral defects. Cylindrical plugs of microporous $\beta$-TCP (diameter: 7mm; length: 25mm; porosity: 43.5±2.4%; pore diameter: ~5\(\mu\)m) with interconnecting pores were used. Scaffolds were seeded with autologous chondrocytes in vitro and cultured for 4 weeks. A drill hole (diameter 7mm) was placed in both medial femoral condyles of sheep. For the left knee the defect was filled with a TCP plug and for the right knee the defect was left empty. After 6, 12, 26 and 52 weeks, seven animals from each group were killed and studied. The samples were examined employing histological, histomorphometric and immunohistological methods as well as various imaging techniques (X-ray, microcomputer tomography and scanning electron microscopy). After explantation the cartilage defects were first assessed macroscopically. There were no signs of infection or inflammation. Histological grading
scales were used for assessment of bony integration and cartilage repair. An increasing degradation (81% after 52 weeks) of the ceramic with concomitant bone formation was observed. The original structure of cancellous bone was almost completely restored. After 26 and 52 weeks, collagen II-positive hyaline cartilage was detected in several samples. New subchondral bone had formed. The formation of cartilage began at the outer edge and proceeded to the middle. According to the O’Driscoll score, values corresponding to healthy cartilage were not reached after 1 year. Integration of the newly formed cartilage tissue into the surrounding native cartilage was found. The formation of biomechanical stable cartilage began at the edge and progressed towards the centre of the defect. After 1 year this process was still not completed. Microporous α-TCP scaffolds seeded with chondrocytes are suitable for the treatment of osteochondral defects.