ABSTRACT

PURPOSE: Articular cartilage defects commonly occur in conjunction with anterior cruciate ligament (ACL) deficiency. A promising method for localized cartilage damage is focal knee resurfacing using metal or polymer plugs. However, these plugs induce damage to the opposing cartilage, which is already examined in vitro for the anteroposterior knee movement. After ACL reconstruction, knee stability is not always fully restored, causing the knee joint to deviate from the anteroposterior movement. This fundamental in-vitro study aims to investigate the influence of sliding direction on cartilage wear following sliding indentation against metal and polymer plugs.

METHODS: 12 porcine tibial plateaus were mechanically tested, of which 6 in anteroposterior direction and 6 in mediolateral direction, with osteochondral, metal and polymer plugs. The mechanical test was based on a reciprocal sliding movement between the plug and cartilage plateau, mimicking the stance and swing phase of the gait cycle. The tested plateaus were analysed during macroscopy and microscopy. The damage was graded using the macroscopic Collins and microscopic OARSI system for osteoarthritic cartilage.

RESULTS: The cartilage plug caused damage to opposing cartilage, resulting in a macroscopic Collins grade of 1 and a microscopic OARSI grade of 1 in both anteroposterior and mediolateral direction. For the metal plug, a macroscopic Collins grade of 3 and a microscopic OARSI grade of 4 was found for the opposing cartilage in both directions. The polymer plug damaged cartilage showed a macroscopic Collins grade of 2 for both anteroposterior and mediolateral direction. A microscopic OARSI grade of 3 was assigned to the anteroposterior opposing cartilage and a grade of 2 to the mediolateral opposing cartilage.

CONCLUSION: Although there are some limitations to this study, the results show that there is indeed a difference in effects between a metal and polymer plug, in which a metal plug induced more damage to the opposing cartilage. The difference between anteroposterior and mediolateral cartilage seems to be minimal. However, due to the insufficient sample size, no statistical analysis could be applied, so these findings cannot be proved. Additional studies are needed to overcome the limitations and statistically support the findings.