



Estimation of the Cartilage Volume Loss Due to Knee Osteoarthritis - Case Study

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ABSTRACT

Osteoarthritis (OA) is a degenerative disease of the knee joint caused by the formation of cracks within the collagen fibers of the articular cartilage. Current research is directed towards less invasive procedures for treating this degenerative disease using tissue engineering and 3D bioprinting. Therefore, it is crucial to obtain the exact shape of the damaged tissue, reconstruct the original shape of the tissue, and estimate the volume and area resulting from the wear of the contact surfaces. The study used the tibial plateau of a patient with OA that was removed during total knee arthroplasty, and the data was collected using a 3D scanner. After the reconstruction of the tibial plateau, an assessment of the area and volume of wear on the medial condyle of the tibia was performed, along with a FEM analysis of the real and approximate shape of the cartilage tissue. In this way, it is possible to simulate and create a patient-specific 3D model with a reconstructed wear volume, which can be highly attractive for future treatment strategies for cartilage damage or early stages of OA.

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1. INTRODUCTION

The complex structure of healthy cartilage in the knee joint provides tolerance to the pressures, such as those caused by weight, to which the knee joint is exposed. In addition, the synovial fluid inside the knee joint

facilitates movement and reduces friction between the contact surfaces of the tibial cartilage and the femoral cartilage. However, if there is damage to the knee joint, which can accumulate over time, it creates conditions for the occurrence of osteoarthritis (OA). The development of OA is also influenced by joint

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