

Case report: Benefits of 3-D Printing and Modelling to Aid Surgical Decision Making and Reduce Surgical Time during Knee Revision Surgery

William Baker

South Tees Hospitals NHS Foundation Trust

Paul Baker

Consultant, South Tees Hospitals NHS Foundation Trust

Abstract:

Background: The demand for revision total knee arthroplasty (TKA) is increasing as the number of primary knee replacements rises and prosthetic implants reach the end of their lifespan. Revision procedures are technically demanding, particularly in cases with significant bone loss, deformity, and implant loosening. Three-dimensional (3D) printing has emerged as a promising tool to support surgical planning by allowing detailed visualisation of complex anatomy and simulation of operative strategies. This report describes the use of a patient-specific 3D printed model to aid decision making in a highly complex revision knee arthroplasty.

Methods + Results: A 77-year-old male presented with progressive failure of a right primary total knee replacement performed 14 years previously. Clinical and radiographic assessment demonstrated severe varus deformity, a fixed flexion contracture, and substantial tibial bone loss. The case was classified as Revision Knee Complexity Classification (RKCC) grade 3 with an Anderson Orthopaedic Research Institute (AORI) type 3 tibial defect. A computed tomography scan was used to generate a life-size 1:1 3D printed model of the knee, enabling pre-operative simulation of the procedure and trialling of implants. This process demonstrated that reconstruction using standard cones and generic implants would be feasible, avoiding the need for a custom implant or proximal tibial replacement. Revision surgery was subsequently performed according to the pre-operative plan in under two hours.

Conclusion: At six weeks post-operatively, the patient mobilised independently without aids and achieved a knee range of motion of 0–110°. This case demonstrates that 3D printed anatomical models can facilitate surgical planning in complex revision knee arthroplasty, support implant selection, and contribute to efficient operative management.