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3D printed patient-specific knee phantom for educational purposes and surgical planning

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Everyone seeks for the best treatment and care possible when they go to the hospital with reduced costs. This is one of the main concerns people have nowadays and what refrain them from going to the hospital for routine checkups. Therefore, there exist an international effort for bringing down clinical costs and taking excellent medical care to everyone regardless of their economic status. So, this project looks for new ways of making that possible. We show an innovative way of reducing operating room time and increasing doctor's performance. We plan to do that by developing a knee phantom from the study and analysis of CT and MRI images that will help doctors plan surgeries beforehand by being able to explore the anatomy of patient more thoughtfully and also be of great use for medical student to practice surgical procedures. The imaging scans were analysed using the software 3D Slicer and consequently segmented using the different built-in tools of the software. Later, 3D printing techniques like fused deposition modelling and stereolithography were used along with its corresponding materials (elastic and solid ones) to produce the model. Different software tools like 3D Slicer, Meshmixer, Horos and Cura were also implemented for the final design and rendering of the phantom. A final study of the flexion/extension and rotative properties of the knee phantom was performed using a self-developed interface in 3D Slicer and MARG sensors accelerometers. And the results were compared to those performed in industrial prosthesis in cadavers.

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