Finite element analysis and comparison of human skulls using MRI driven 3D printing

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Abstract

3D printing has been shown to be an increasingly useful application in the field of medicine. Using MRI or CT imagery, 3D printed models have been used in order to plan surgery using accurate models of patient anatomy. This process allows surgeons to better understand and strategise procedures in a safe and non-invasive manner. 3D printed models have also been manufactured in order to reconstruct the skull and jaw in the case of trauma. By using 3D modelling following medical imaging techniques, reconstruction can be extremely accurate in both structure and durability and could provide more personalised care. This study used a Bio-CAD image-based modelling technique. Initially, a head and neck MRI were taken of two subjects. These images were then imported using Simpleware ScanIP software whereby Computer-Aided- Design (CAD) was used to generate several STL files. Anatomical structures are then manufactured using Fused Deposition Modelling (FDM) and Stereolithography (SLA). Finite element analysis is also undertaken to investigate each model's ability to withstand forces on different stress points which can be used for impact/shock analysis. Using these MRI rendered 3D printed skulls, this project intends to better understand the possible uses for this technology in several fields of medicine.

Biography

Dan O' Leary is studying Medicine at the University of Exeter Medical School. He is currently in his 5th year, intercalating in BSc Sport & Exercise Medical Sciences.

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