DEVELOPMENT OF 3D-PRINTED ABDOMINAL PHANTOM FOR QUALITY ASSURANCE APPLICATIONS

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Abstract

Computed Tomography (CT) is a diagnostic modality that utilizes x-ray to obtain a volumetric scan of an object's body and is commonly used as an immediate imaging modality for emergency situations and diagnosis of possible malignancies especially for abdomen-related cases such as appendicitis and kidney injuries. Phantoms are employed to evaluate the performance of radiation-emitting equipment such as CT to ensure that such equipment can be used in clinical applications. Phantoms range from geometric to human anatomy-mimicking structures. Anatomy-mimicking phantoms offer a number of advantages over geometric phantoms such as providing a more realistic simulation of anatomical region of interest [1]. However, anatomy-mimicking phantoms are generally costly which could hinder use of this phantom type in the clinical setting. The research aims to develop a customized water-mimicking 3D abdominal phantom using 3D-printing technique. Volumetric measurements of the organs inside the phantom were derived from the average organ measurements of selected individuals. Resin 3D printing process was employed to fabricate the organs of the phantom. Diagnostic CT scanner was used to obtain volumetric scans of the phantom without and with water filling. ROI analysis was conducted to determine the Hounsfield Unit (HU) of the phantom under selected parameters. HU measurements of the phantom with and without water filling were within the tolerance indicated by the ACR and IAEA method. Results of this research could be used as a comparison of image quality between two different CT scanners for quality assurance applications. Moreover, results of this study can be employed in the development of phantom for dynamic and kinetic imaging using the total-body J-PET scanner [2].

References

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