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Comparison of 3D scanned kidney stone model versus computer-generated models from medical images

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ABSTRACT

With a goal to evaluate accuracy of kidney stone models created from medical images, comparison of computer-generated models against 3D scanned model is performed. Computer-generated models are made using 6 free and one commercial software for medical images obtained by computed tomography (CT) with a slice thickness of 5 mm. Digitized volume of the same kidney stone was obtained after its surgical removal and digitized using a contactless 3D scanner ATOS Compact Scan. Due to the complexity of kidney stone, the scanned reference model is not completely identical to real surgically removed stone from a patient. High maximum deviation is positioned mainly in the areas where the actual kidney stone is not scanned. The average surface deviation is in the range of 0.24354 mm to 0.44719 mm. Results reveals that the accuracy of the computer-generated models depends on quality of algorithms for tissue segmentation implemented in a particular software and on the skill of user. All software enabled us to create a 3D model of the kidney with clearly visible position of a kidney stone inside, accurate enough for planning the operation. It is possible to get a higher model accuracy by reducing the slice thickness during medical imaging; however, it increases the dose of radiation. Therefore, it is necessary to individually determine the optimum balance between the required quality of images and the amount of radiation that the patient is exposed to during recording.

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