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Evaluation of a commercial orthopedic metal artefact reduction tool in radiation therapy

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Introduction & Aim: Computed Tomography images in radiation therapy are used to localize the Planning Target Volume (PTV), the Organs at Risk (OARs) and calculate the dose distribution by Treatment Planning System (TPS). Image artifacts could lead either a wrong definition of structure contours by the clinician either an erroneous computation of dose due to inaccuracies in the Hounsfield Unit (HU) values. Radiotherapy patients often have metal implants and this causes several image artifacts. This study focused on the advantages using a commercial metal artifacts reduction algorithm, O-MAR (Philips Healthcare System, Cleveland, OH) and its effect on dose calculation.

Methods & Materials: The study five head and neck cases were considered with metal dental implants. Patients were scanned on a large bore CT Brilliance Philips. The scanned images were reconstructed with standard and O-MAR algorithm for each patient. The structures drawing by the clinicians on the O-MAR series were copied on the originally CT images to evaluate the dose distribution on the same volume. Plans were performed on Pinnacle TPS with Intensity Modulated Radiation Therapy Technique (IMRT). The treatment provided two or three PTVs respectively with 54/66 Gy and 54/60/66 Gy and dose were evaluated on different OARs, close to the artifacts region, such as bone marrow, parotids and mandible. Hounsfield units variation was analyzed also in additional Region of Interest (ROI) near the dental implant.

Results: In OMAR images, noise value is reduced and standard deviation of HU is lower than in standard reconstructed images. Statistical analysis on HU values was performed, but no significant difference between the two data sets was founded. Evaluating the dose distribution and the Dose Volume Histogram (DVH) with the physicians, no significant differences were detected by a clinical point of view.

Conclusion: In head and neck case, when patients have dental implants, the use of O-MAR improve the entire radiation treatment planning process, especially for contouring because increase the accuracy of CT HU and reduce the noise. No significant changes in dose calculation were found.

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