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Title : **Electron Beam Dose Distribution In Electron Treatment Planning System With The Presence Of High Density Dental Amalgam In Radiotherapy Treatment**

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Electron beam therapy dose calculation has become a great challenge in modern radiation treatment. Differences of tissues composition in human lead to unexpected dose perturbation and often neglected by dose calculation systems. On the other hand, metal amalgam causes a prominence streak artifact in computed tomography (CT) image thus contributed uncertainties in dose calculation. This thesis focuses on perturbation effect on electron dose calculation and provides a strategy in reducing dose errors in patient with amalgam fillings undergoing electron beam treatment. Effects of inhomogeneity and metal streaking artifact on Pencil Beam (PB) calculation were first studied. Comparisons between PB calculations with measurement data were conducted using 9 MeV electron beam. As a result, the PB calculation is suggested to be limited for regions where dose perturbations and streak artifact were trivial. In head and neck cases metal amalgam often creates streak artifacts that cause error in dose calculation. Therefore, the dose error was quantified in this thesis using Monte Carlo (MC) calculation. A metal artifact reduction (MAR) technique was applied to correct the images and as for consequences a better quality of images were observed. Total dose errors cause by streak amalgam fillings were observed as high as 44% by the comparison of pre and post corrected images. The improvement method included the reductions of streaks and correction of amalgam density in the images. The amount of dose perturbations caused by dental and dental amalgam samples was also quantified. MC calculation was utilised to provide a data on central axis depth dose and horizontal dose profiles. Obviously dose distributions were changed significantly due to interactions between electrons particles with inhomogeneous medium. Results showed that the scattered interaction predominate electron interactions in dental samples subsequently causing reduction of absorbed dose in dental. Whereas dental amalgam sample, demonstrated high dose absorptions via interactions between electron particles with amalgam. The need of MAR technique in dose calculation algorithm was further investigated. With the corrected image data, radiotherapy objectives can be achieved successfully. Considering this factor, this thesis suggests a precaution step to avoid calculation errors due to amalgam fillings streak artifact. With the number of vital and radiosensitive organs in head and neck regions, MAR technique was compulsory in this case. In conclusion, this thesis has explored the possibility of errors in dose calculation when high density objects present in the treatment field. Errors in dose calculation can be minimized if every uncertainty arises are handled carefully as suggested in this thesis.