## Transmission dosimetry with a liquid-filled electronic portal imaging device.

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The aim of transmission dosimetry is to correlate transmission dose values with patient dose values. A liquid-filled electronic portal imaging device (EPID) has been developed in our institution. After determination of the dose response relationship, i.e. the relation between pixel value and dose rate, for clinical situations we found that the EPID is applicable for two-dimensional dosimetry with an accuracy of about 1%. The aim of this study is to investigate transmission dose distributions at different phantom-detector distances to predict exit dose distributions from transmission dose images. An extensive set of transmission dose measurements below homogeneous phantoms were performed with the EPID. The influence of several parameters such as field size, phantom thickness, phantom-detector distance and phantom-source distance on the transmission dose and its distribution were investigated. The two-dimensional transmission dose images were separated into two components: a primary dose and a scattered dose distribution. It was found that the scattered dose is maximal at a phantom thickness of about 10 cm. The scattered dose distribution below a homogeneous phantom has a gaussian shape. The width of the gaussian is small at small phantom-detector distances and increases for larger phantom-detector distances. The dependence of the scattered dose distribution on the field size at various phantom-detector distances has been used to estimate the dose distribution at the exit site of the phantom. More work is underway to determine the exit dose distributions for clinical situations, including the presence of inhomogeneities.



## IN VIVO DOSIMETRY WITH L-α-ALANINE

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When organic substances are irradiated, stable unpaired electrons can be formed. The concentration of these electrons is detected via electron paramagnetic resonance (EPR), a non-destructive form of dosimetry. L-α-alanine is extremely suited as a detector because of its high stability and high yield of unpaired electrons.
With an EMS 104 spectrometer, we measure the peak-to-peak value of the first derivative of the resonance-spectrum. This value is proportional to the concentration of unpaired electrons and therefore with the absorbed dose.
Prior to the in vivo measurements in teletherapy, a calibration curve had to be established. This clearly showed a linear relationship between the EPR-signal and the absorbed dose, except for very low dose where precision was low (20% 1SD). This indicates that the background signal of the dosimeter is strongly orientation dependent. For this reason we decided to use pre-irradiated detectors.
With this in mind we performed a number of in vivo measurements, from which it became clear that error propagation plays a major role with the calculation of the measured absorbed dose, in the range 1 Gy-6 Gy. Contrary to in vivo measurements in brachytherapy, where higher doses are measured, large uncertainties (30% 1SD) on our entry dose calculations were perceived.
We therefore propose to use a statistical method of reducing this standard deviation to an acceptable level. Our method, consisting of 2 detectors and the usage of weightcoefficients on our standard deviations, gave promising results.
However, theoretical calculations and in vivo measurements show that this method is still not satisfactory to reduce the uncertainty to an acceptable standard in clinical situations.