The Impact of Hydration and Microwave Power on EPR Signals in Fingernails/Toenails

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Potential exposure of large numbers of people to clinically significant levels of ionizing radiation is now a serious concern because of the potential for acts of terrorism and accidents with radiation. We are developing methods to determine exposure to ionizing radiation based on electron paramagnetic resonance (EPR) measurements of radicals generated by radiation in fingernails. The use of fingernails has several potential advantages: the samples can be obtained readily by simple clipping, the measurements can be made quickly, and the parameter that is used, the amount of radiation-induced radicals, is not potentially confounded by factors that can affect other types of approaches based on biological samples; i.e. the signals are unaffected by stress, wounds, or burns. However, the act of clipping of fingernails does generate mechanically induced signals (MIS) that potentially can interfere with measurement of the radiation induced signal (RIS). In order to develop analytic techniques for fingernails we need to use clipped fingernails as a sample source. The act of clipping necessarily precedes the irradiation for these studies, while for the use of the technique in the field, the radiation would occur before the clipping. We therefore have utilized treatment of fingernail samples with water for different time periods aimed at restoring nails to their *in vivo* condition. We have found that treatment of the fingernails for 10 minutes significantly decreases the MIS. A key question is whether this treatment affects the subsequent response of the fingernails to exposure to ionizing radiation. To determine this we are pursuing two complementary approaches. One is to utilize long samples of fingernails. Presumably in such fingernail samples, the part of the nail distal from the clipping will undergo less mechanical stress. Therefore we have carried out a series of studies in which we irradiate such samples with or without prior treatment with water, and then clip them into two parts: a part that has both the initial clipping and the subsequent clipping after the irradiation and the second part which should simulate the situation that would be encountered in the field, where the clipping occurs only after irradiation (this assumes that part of the nail was sufficiently distant from the original clipping to have little or now MIS in it prior to irradiation. The second approach is to obtain samples from patients undergoing total body irradiation for therapeutic purposes. The data from these ongoing studies will be summarized.

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