A preliminary study of the thermal measurement with the nMAG gel dosimeter by MRI

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For the last decade, many types of gel dosimeters have been widely used to verify the radiation dose in the field of radiation therapy. The nMAG dosimeter which is a less toxic normoxic polymethacrylic acid gel proposed by De Deene *et al.* is expected to be an effective tool for three-dimensional quality assurance for therapeutic systems. In addition to radiation induced polymerization, the nMAG dosimeter also responds to temperature variations. In this study, we proposed a new way to evaluate the thermal response using the gel dosimeter. The nMAG was prepared using ultra-pure deionized water, 8% gelatine (porcine skin, 300 bloom, Sigma Aldrich), 8% methacrylic acid (∼99% titration,Sigma Aldrich), and 2mM tetrakis(hydroxymethyl)phosphonium chloride(THPC). The test tubes of nMAG were heated for 1 and 10 minutes, respectively, using the double-boiling method with the temperature ranging from 30°C to 80°C. A 1.5T MR scanning (Siemens Sonata, Erlangen, Germany) with a total of 32 multi-spin echo pulse sequence was performed. Several properties of nMAG have been investigated including the relaxivity rate R2 (= 1/T2) of MRl, the temperature sensitivity, and the linearity of temperature response. The R-square values for 1 min and 10 min heated were 0.832 and 0.851, respectively, ranging from 30°C to 80°C. In which, under the temperature of 40°C to 70°C, the R-square values were increased to 0.988 and 0.951, respectively. The measured data showed that the nMAG gel dosimeter had a linear response to the temperature. Moreover, the nMAG gel dosimeter has a higher linearity and sensitivity in the range of 40°C to 70°C. In the future, we will investigate the precise limitation of thermal response to the nMAG gel dosimeter. We conclude that the polymer gel dosimeters have the potential as a measurement tool for evaluation of the thermal surgery.