Ortho-positronium in human tissues - highly sensitive cancer diagnostics at the nanostructure level

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Positron Annihilation Lifetime Spectroscopy (PALS) was used to investigate the nano-scale morphology, water content and the radical concentration of healthy and diseased human liver tissue. Two samples each, were taken from healthy and altered liver tissues coming from four patients: three of which were diagnosed with malignant colorectal cancer that has metastasized into the liver and one patient with a primary benign tumor. We adopted the multi-component model to determine the degree of liver lesions, the type of neoplastic lesion and the water content of the tissue. INTI plot mapping was used to determine the type of neoplastic lesions. The total water content (free and physiosorbed) of healthy and altered liver tissue was estimated (Fig. 1). We deduced the chemical composition (radicals and O_2 concentration) of the tissue related to the chemotherapy treatment. The above observations and the resulting conclusions may be used to develop additional functionality of new generation PET scanners in the field of non-invasive diagnostics accompanying imaging.
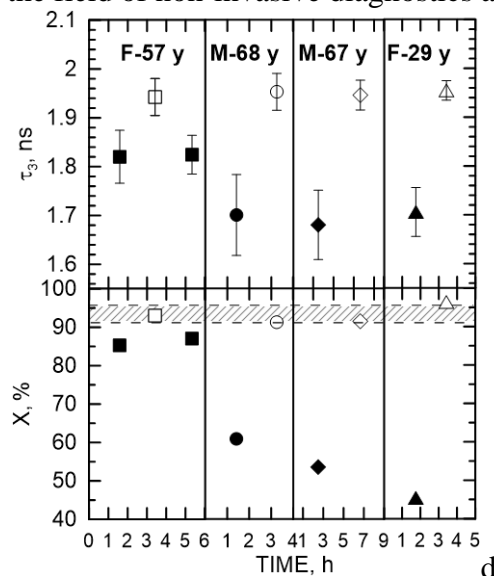
Fig.1. The o-Ps lifetime (τ_3) and water content (X) in healthy (empty points) and tumor (full points) liver tissues taken from women (F) and men (M) in different ages. The hatched area corresponds to the water content of healthy tissues.