

Medical Solutions

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Background information: Functionality of magnetic resonance tomography

Two-thirds of the human body consists of water. The water molecule consists of two hydrogen atoms and one oxygen atom. The nucleus of the hydrogen atom – the proton – can be compared to a magnetic top. MRI utilizes these physical characteristics. In a strong magnetic field – generally 30.000 times stronger than the earth's magnetic field – randomly processing protons align in parallel or anti-parallel direction to the magnetic field orientation. Depending on the strength of the magnetic field, a more or less high number of excess spins occurs for the protons aligned in one direction. This results a measurable magnetic moment.

By supplying electro-magnetic high-frequency energy, the alignment of the excess spins can be changed. The magnetic moment begins to precess about the field lines of the magnetic field. After the electro-magnetic stimulation is ended, the excited protons reemit the energy obtained by generating magnetic fields that are received by a coil. The signal strength increases as a function of the excess of nuclei aligned in one direction, that is, the stronger the magnetic field, the stronger the signal. Spatial changes in the magnetic field allow the allocation of MR signals to their point of origin. Using computer reconstruction programs, medical images similar to X-ray computed tomography can be generated. The contrast obtained in the MR image is a function of the spatial distribution of the water contained in the organs, as well as the relaxation times, that is, the times required to return to the original state (equilibrium) after the RF energy has been switched off.

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