Moving forward with magnetic hyperthermia: can we profit from intracellular clustering of the magnetic nanoparticles?

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The possibility of using Magnetic hyperthermia (MHT) as a standalone therapy requires reaching acceptable therapeutic effects with minimum concentration of heating agent. With obvious advantages for the treatment of deep, inaccessible human tumors, MHT aims to increase the local tumor temperature up to apoptotic levels, with minimal side effects on the surrounding healthy tissue.[1] A necessary step to this aim is the design of field-efficient magnetic nanoparticles (MNPs) as heating agents within the intracellular environment. By numerical simulation of the response under magnetic fields, the magnetic parameters of MNPs such as magnetic anisotropy and dipolar interactions are optimized within a numerical model of the relaxation mechanisms so that the heating efficiency is preserved in the intracellular environment. The output of this protocol is the largest in vitro specific power absorption (SPA) values reported so far.[2] However, the role of dipolar interactions due to intracellular agglomeration found from the numerical solutions to be the main cause of changes in the magnetic relaxation dynamics of MNPs, is not yet completely understood. The experimental and theoretical body of data needs to be completed in order to unveil these mechanisms, especially for *in vitro* and *in vivo* conditions, before aiming a physical design of MNPs that can retain their heating efficiency in clinical hyperthermia experiments.

References

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