Abstract

The role of ultrasound in medicine and biological sciences is expanding rapidly beyond its use in conventional diagnostic imaging. Numerous studies have reported the effects of ultrasound on cellular and tissue physiology. Advances in instrumentation and electronics have enabled successful *in vivo* applications of therapeutic ultrasound. There have been key developments in the biological applications of ultrasound especially in the context of sonoporation. The non-thermal mechanical bioeffects caused by cell-ultrasound interaction increases cell membrane permeability. Increased endocytosis of drugs, nanoparticles and chemotherapeutic agents through porous membrane have wide array of applications. These rely on the synergistic action of a therapeutic agent as well as a medical device, hence the regulatory pathway is more challenging than either a drug or a device alone. Thus, the research and development for ultrasound parameters is crucial to find specific treatments. For this, we are focused on finding optimum parameters as well as the effects ultrasound have on cellular morphology. We have established the protocol for ultrasound treatment with minimum requirements. The evidence was the intracellular uptake of impermeable dye, Propidium iodide under ultrasound treatment. Optimization of ultrasound parameters such as intensities and exposure time were done for various molecular weights of FITC-Dextran's. We have established the novel uptake of DNA nanocages through ultrasound. Regarding safety concerns, our studies with fluorescent compounds such as MitoTracker, CTxB, LipiDox, DiL red and Phalloidin checked for the adverse effects of ultrasound on cells morphology. We found that the morphology of cellular components like mitochondria, lipid membranes, neutral lipid molecules, actin filaments remain unchanged after the treatment. This will further help us to develop protocols for specific clinical treatments as well us will enhance our understanding of underlying mechanisms of interaction between ultrasound parameters and cellular components.