2012

Characterisation of the Acoustic Output of Three Sonoporation Drug Delivery Ultrasound Systems Using an Acoustic Radiation Force Balance

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Recommended Citation

Mabvaro, T., Browne, J. : Characterisation of the Acoustic Output of Three Sonoporation Drug Delivery Ultrasound Systems Using an Acoustic Radiation Force Balance. Physica Medica, Vol. 28, no.4, 2012, p. 343. doi:10.1016/j.ejmp.2012.06.041

Characterisation of the acoustic output of three sonoporation drug delivery ultrasound systems using an acoustic radiation force balance

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In this study, the acoustic output from three sonoporation drug delivery ultrasound systems, namely Sonidel SP100 were characterised using an acoustic radiation force balance. Delivery of nucleic acid to a target tissue as a form of gene therapy is an important means of treating a variety of disorders, for example cardiovascular disease. One method of this type of treatment utilises ultrasound to stimulate cell membrane permeabilisation (sonoproation) for the purpose of transferring nucleic acids into cells. This approach offers advantages over competing technologies such as viral vectors, primarily as a result of its relatively non-invasive nature. However, the ultrasound sonorporation systems used to produce this permeability of the cell need to be fully characterised in order to provide the most effective treatment. Therefore, in this study acoustic output measurements were made for three SP 100 ultrasound systems and the output obtained from each system were compared to determine whether each of the three systems had similar performance. An absorbing target acoustic radiation force balance was used to obtain these measurements, the resolution of this system was 1 mN. The results from each system operating in continuous mode were compared using a t-test and the results were found to similar at a significance level of $p < 0.05$and the re-testing demonstrated that three systems had repeatable outputs. Both the continuous and pulse wave mode settings were tested at different intensities and a representative of these results are presented in the figure below. As well as testing the manual setup, automated analysis was also carried out using a dedicated LABVIEW program. The results obtained for both the manual and automated set-up will be presented as well as the results for the different pulsed wave mode settings.