

## **Exposure to RF fields emitted by GSM and TETRA phones does not harm treatment of patients with dual-chamber pacemaker**

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The effects of GSM (1800 MHz) and TETRA (380 MHz) phones on cardiac pacing was studied in 57 patients with implanted dual-chamber pacemakers from three manufacturers (21 patients with Medtronic pacemakers, 27 patients with St. Jude Medical pacemakers and 9 patients with Guidant pacemakers).

The patients were studied in supine position during routine polyclinic visits for the function adjustment of their earlier implanted dual-chamber pacemaker. In order to evaluate possible pacemaker malfunction in the presence of external RF disturbance produced by 1800 MHz GSM phone and TETRA phone, the pacemakers were programmed to different pacing and sensing modes by a clinical cardiologist. The both mobile phones were adjusted with a PC-based mobile phone control software to operate at the allowed maximum antenna powers (OFF for 20 s and ON for 20 s) during clinical testing for possible RF interference of pacemakers. Four consecutive mobile phone locations were applied during clinical testing: 1) the GSM phone and TETRA phone were positioned in separate sessions on the contralateral ear, 2) on the ipsilateral ear, 3) at a distance of 15 cm from skin above the pacemaker, and 4) on skin just above the pacemaker.

Several physiological signals (body surface ECG, telemetrically measured intra-cardiac signals and continuous finger blood pressure, if available) were recorded and analog-to-digital converted with simultaneous recording of the relative intensity signal of RF field. The data analysis of the recorded signals was conducted in this trial by a special post-processing software package using feature extraction of ECG, blood pressure and pacemaker function signals to obtain accurately the time-synchronized time series of cardiovascular variabilities during different pacemaker function modes.

Contrary to some earlier reports, our results indicate that RF field emissions by GSM (1800 MHz) and TETRA (380 MHz) phones do not cause interference to pacemaker functions (pre-programmed sensing and pacing). The only observed harmful effects were found in signal telemetry with the 1800 MHz GSM phone, when the phone was located in close proximity to pacemaker above the chest. However, RF exposures using 1800 MHz GSM phone did not change the pre-programmed function of the pacemaker. Signal telemetry problems did not happen during TETRA phone RF exposure.

As a conclusion, normal use of GSM (1800 MHz) or TETRA (380 MHz) phones by pacemaker patients does not induce any significant clinical problems on intra-cardiac sensing and pacing even in situations, when mobile phone is close to cardiac pacemaker.