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# Interference and implantable cardiac stimulators

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## Abstract

As pacemakers and defibrillators are electronic devices that elaborate electrical signals, they are by nature sensitive to electromagnetic signals. The crucial problem is not so much to establish which devices are susceptible to such physical phenomena, but rather to determine threshold levels and the precautions required to ensure that the devices function properly. The preferential pathways of interference between an external electromagnetic source and an implanted device are constituted by catheters, antennas used in telemetry, magnetic switches, and rate-responsive sensors; that is to say, those components which in some way communicate with the external environment. The human body, which is a fairly good conductor of electricity, acts as an effective shield against electrical fields surrounding the patient, thereby intrinsically protecting the implanted device.

The internal microprocessor and electronic interfaces are based on the c-mos technology, which is sensitive to ionising radiation that can alter the conduction thresholds of the transistors. Moreover the electronic components and the ceramic base supporting them can be mechanically damaged by high power vibrations like high power ultrasounds.

The aim of this review is to summarise the recommendations for all professionals managing patients with an implanted cardiac stimulator in case of interference most frequently encountered in hospital, at home and in everyday life.

KEYWORDS: Pacemaker, DeWbrillator, Interference.

## Original Paper

# Variation in electrical tissue admittivity after exposure to different types of acoustic energy, an *in vitro* study

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## Abstract

The effects of three modes of acoustic energy on electrical admittivity of *in vitro* tissue have been studied. Thirty-four muscle tissue samples were irradiated with either extra corporeal shock wave lithotripsy (ESWL) or high intensity focused ultrasound (HIFU) in pulsed or continuous wave. Significant changes in magnitude of admittivity were detected only during continuous HIFU when temperatures over 44°C were generated. The admittivity decreased by 35% during these protocols. The phase angle of impedivity increased during all our protocols. The increase was approximately 50-70% depending on the temperature elevation and the mode of delivery. We conclude that both non-thermal and thermal effects have an impact on phase angle of the target tissue. The decrease in magnitude of admittivity however is caused by heat. These results indicate that admittivity based methods for monitoring lesion volume during ultrasound radiation might be feasible. It is also interesting to emphasise that non-thermal effects, caused mainly by cavitation and shockwave formation, can be detected as a change in the measured phase angle.

KEYWORDS: Acoustic radiation, Electrical impedance/admittance, *In vitro* muscle tissue.

# Evaluation of the efficacy of commercial devices used for protection against electromagnetic fields emitted by cellular phones

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## Abstract

This study aims to experimentally assess the protective efficacy against electromagnetic radiation emitted by cellular phones of some commercially available devices of different shapes and sizes. Comparative measurements have been performed of electromagnetic power absorbed per unit of mass (SAR, Specific Absorption Rate, W/kg) and of the diagram of far-field radiation to assess eventual changes in the quality of the signal emitted by cellular phones. The results show that even if the devices are used according to the manufacturer's instructions they are ineffective. However, in certain conditions, some of them seem to be able to modify the structure of the electromagnetic field generated by the phone antenna as suggested by variations (increase or decrease) in the SAR and by the results of the radiometric measurements carried out applying the devices in different positions on the phone. The behaviour of another kind of devices has been examined, widely used with cellular phones, designed to have free hands through the use of earphones, and also used to reduce exposure of the head to electromagnetic fields. In response to the doubts raised by a British consumer association, a series of comparative measurements have been made under specific conditions to verify the actual electromagnetic energy dissipated in the head through the earphone or directly by the telephone itself. About twenty devices have been analysed with the telephones of three producers. The analysis has confirmed the significant reduction of the electromagnetic energy dissipated in the head by the use of hands free kits.

KEYWORDS: Cellular phones, Radiofrequency, Shields, Hands free kit.

## Letter to the Editor

# A new type of breast contact thermography plate: a preliminary and qualitative investigation of its potentiality on phantoms

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## Abstract

Detection of angiogenesis, which is present from the earliest phases of breast cancer development needs evaluation of subtle functional blood supply variations. To this purpose we investigated, by means of physical phantoms, the technical imaging obtained by a new type of cholesteric liquid crystal plate. We have performed 4 tests, comparing two plates: A, the subject of the present paper, and B, one that is commercially available.

Aspects of the superficial heat distribution associated with the anatomic arrangement of blood vessels in the breast were simulated by perspex phantoms containing electrical heat resistances and where their functional activity was simulated by small tubes in which warm water circulated.

The plate A exhibited far superior spatial resolution, image retention and rapidity of response.

These experiments can help in the characterisation of a cholesteric liquid crystal plate and in a better understanding of the blood circulation imaging.

KEYWORDS: Thermographic plate features, Contact thermography, Breast disease.