

Proof of Principle Tests Confirm Genotoxic Potential of RF-EMF

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INTRODUCTION

There is ample literature which demonstrates effects of RF-EMF on structure and function of the genome of mammalian cells in vitro and in vivo [1]. The European REFLEX-project and a follow-up study carried out at the Medical University of Vienna (MUW) impressively confirm the genotoxic potential of 50 Hz ELF-EMF, 1800 MHz GSM RF-EMF and 1950 UMTS RF-EMF [2,3,4].

MATERIALS AND METHODS

In the REFLEX study, human primary fibroblasts were exposed continuously or intermittently (5 min on/10 min off) up to 24 hours to ELF-EMF below the flux density of 2 mT and to 1800 MHz GSM below the SAR of 2 W/kg. In a follow-up study, these cell lines were exposed continuously or intermittently (5 min on/10 min off) up to 48 hours to 1950 MHz UMTS below the SAR of 2 W/kg. In the REFLEX study [2,3] the samples were analysed with the alkaline and neutral comet assay by calculating the comet tailfactor (CTF) as a measure for DNA strand breaks. In the follow-up study [4], only the alkaline comet assay and, in addition, the micronucleus test counting the micronuclei (MN) after blocking the cytokinesis with cytochalasin B were used for analysis. All EMF-exposed samples were compared with sham-exposed and negative and positive controls. All evaluations were performed under blinded conditions and by the same investigator (E.K.).

RESULTS

An increase in single and double DNA strand breaks was observed in human fibroblasts after exposure to 50 Hz ELF-EMF at a flux density below 2 mT. The increase over 15 to 20 hours which varied depending on the age of donors was followed by a rapid decrease during the final stage of exposure which also varied depending on the age of the donors. The decline of DNA strand breaks as well as the differences in the increase and in the decrease can be attributed to the activation of the cellular DNA repair mechanisms and their effectiveness which is diminished with increasing age of the donors. The increase in DNA strand breaks was already significant at a flux density as low as 35 μ T.

1800 MHz GSM, too, generated a significant increase of DNA strand breaks in human fibroblasts after a continuous or intermittent (5 min on/10 min off) exposure for up to 24 hours. Effects occurred after an exposure time of 16 and 24 hours, with continuous wave and different mobile phone modulations, but could not be observed after 4 hours of exposure. After intermittent exposure the rate of DNA strand breaks was higher as compared to continuous exposure. This clearly demonstrates that the induced DNA damage is not based on thermal effects. A significant increase in the DNA strand breaks was found with the alkaline comet assay at a SAR of 0.3 W/kg.

Not unexpected, also the UMTS exposure significantly increased the DNA strand break frequency and in addition the number of micronuclei in human fibroblasts in a dose- and time-dependent manner. At a SAR of 0.1 W/kg the increase in DNA strand breaks was significant after 8 hours of exposure ($p < 0.02$), while the number of micronuclei significantly rose after 12 hours of exposure ($p < 0.02$). A significant effect could already be seen at SAR of 0.05 W/kg, but in this case an exposure time of 24 hours was needed. No UMTS effect was observed with lymphocytes, unstimulated or stimulated with phytohemagglutinin.

CONCLUSIONS

The proof of principle experiments which have been carried out by us and others, too, clearly demonstrate the genotoxic potential of ELF and RF-EMF. The numerous negative results in this area of research cannot be accepted as proof of the opposite. What is needed now, are biophysical and/or molecular-biological studies aimed at the detection of the basic mechanisms which are the underlying causes of the genotoxic effects. This kind of information is urgently needed for the development of a new generation of safety limits necessary to replace the present anachronistic values the rationale of which contradicts the state of scientific knowledge.

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