Non-Thermal Electromagnetic Radiation Damage to Lens Epithelium

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Abstract: High frequency microwave electromagnetic radiation from mobile phones and other modern devices has the potential to damage eye tissues, but its effect on the lens epithelium is unknown at present. The objective of this study was to investigate the non-thermal effects of high frequency microwave electromagnetic radiation (1.1GHz, 2.22 mW) on the eye lens epithelium in situ. Bovine lenses were incubated in organ culture at 35°C for 10-15 days. A novel computer-controlled microwave source was used to investigate the effects of microwave radiation on the lenses. 58 lenses were used in this study. The lenses were divided into four groups: (1) Control lenses incubated in organ culture for 10 to15 days. (2) Electromagnetic radiation exposure group treated with 1.1 GHz, 2.22 mW microwave radiation for 90 cycles of 50 minutes irradiation followed by 10 minutes pause and cultured up to 10 days. (3) Electromagnetic radiation exposure group treated as group 2 with 192 cycles of radiation and cultured for 15 days. (4) Lenses exposed to 39.5ºC for 2 hours 3 times with 24 hours interval after each treatment beginning on the second day of the culture and cultured for 11 days. During the culture period, lens optical quality was followed daily by a computer-operated scanning laser beam. At the end of the culture period, control and treated lenses were analyzed morphologically and by assessment of the lens epithelial ATPase activity. Exposure to 1.1 GHz, 2.22 mW microwaves caused a reversible decrease in lens optical quality accompanied by irreversible morphological and biochemical damage to the lens epithelial cell layer. The effect of the electromagnetic radiation on the lens epithelium was remarkably different from those of conductive heat. The results of this investigation showed that electromagnetic fields from microwave radiation have a negative impact on the eye lens. The lens damage by electromagnetic fields was distinctly different from that caused by conductive heat.