NEUROLOGICAL CASE STUDIES

Cases of neurological effects, particularly dysaesthesiae, have been reported after exposure to much of the frequency range. In some cases symptoms are transitory but lasting in others. After very high exposures there is evidence that nerves are grossly injured, but after lower exposures resulting in dysaesthesia symptoms ordinary nerve conduction studies find no abnormality, but current perception threshold studies may. Only a small proportion of similarly exposed persons develop symptoms. The role of modulations needs clarification. Some of these observations are not consistent with the prevailing hypothesis of health effects. Some of these studies are summarised in the table below.

Study	Subject(s)	Medical History	Exposure	Symptoms	Post-exposure Examinations	Comments
Hocking B, Westerman R. "Neurological abnormalities associated with mobile phone use" *Occupational Medicine*, Vol. 50, No. 5, pp. 366-368, 2000.	A 72 year old man.	The man had experienced neck problems for 8 years and had a history of whiplash which caused frontal headaches. Flashes in the right eye at night 6 weeks prior were diagnosed as 'vitreous shrinkage and detachment from the retina'. He had a history of tachycardia and was taking diltiazem as well as simvastasin for controlling cholesterol levels. He had a history of dermatitis on the legs and torso and used betamethasone cream on these areas.	GSM mobile phone calls for about 1 hour on two consecutive days.	Bruised feeling lasting more than a year over the right parietal, temporal, auricular and cheek areas and into the neck. This was described as distinct from the frontal headaches.	A neurological consultant found no abnormalities. Neurophysiological testing using CPT found results consistent with the patient's significant hypo-aesthesia and hypoalgesia involving the cervical and trigeminal nerve distributions.	The onset of persistent symptoms on one side of the scalp involving two separate nerve routes is consistent with a causal effect by fields from the phone.
Kolmodin-Hedman B *et al* "Health problems among operators of plastic welding machines	113 RF welders. 51 men. 62 women. 23 sewing	No details given.	25-30 MHz signals from plastic welding machines. More than 50% of the welding machines exceeded 250 W/m^2 at different parts	40 % of welders had dysaesthesia compared with 22 % of controls.	Two-point discrimination was significantly diminished in welders (39/113) compared to controls (1/23). Nerve	This study shows the exposures caused symptoms not

and exposure to radiofrequency electromagnetic fields" *Inter Archives of Occupational and Environmental Health*, Vol. 60, pp. 243-247, 1988.	machine operators and assembly workers as controls.		of the operator relative to the machine.		conduction studies did not find significant abnormalities between 38 symptomatic welders (12/38) and the controls (5/23).	detectable on ordinary nerve conduction tests in 26/38 welders.
Marchiori PE *et al* "Acute multiple mononeuropathy after accidental exposure to oven microwaves" *Occupational Medicine*, Vol. 45, No. 5, pp 276-277, 1995	A 40 year old woman	No details given	Microwave oven radiation (2450 MHz) for 26 seconds.	Numbness and paraesthesia in right hand fingers ten minutes after. Intense burning pain in the right hand and extraordinarily sensitive to contact stimuli after one day. More intense burning, dystrophic changes in the nails, dysaesthesia of the right side of the face, reduced vision of the right eye and sporadic flushing of the neck.	Clinical tests showed oedema, cyanosis in the right hand and flushing in the anterior area of the neck. Neurological tests showed sensory dysfunction with tactile hypoaesthesia, hyperpathia, moderate glove hypoaesthesia and causalgia of the right hand. An electromyographic evaluation showed involvement of both median nerves more intense in the right hand.	Intense RF exposure has resulted in frank neurological injury.
Schilling CJ "Effects of exposure to very high frequency radiofrequency radiation on six antenna engineers in two separate incidents" . *Occupational Medicine*, Vol. 50, No. 1, pp. 49-56, 2000.	<u>Case Report 1</u>: 4 male engineers. <u>Case Report 2</u>:	<u>Case Report 1</u>: Annual examinations by a doctor, a static ECG, full blood picture and biochemistry detected no health problems in the past apart from one man who had symptoms 2 years preceding this incident. <u>Case Report 2:</u> No man had past history	<u>Case Report 1</u>: VHF and UHF signals while working on a TV antenna for 3 months. Max field strength of 400 V/m with an average of 100 V/m. Max estimated power density of 200 W/m^2 with an average of 27 W/m^2. <u>Case Report 2:</u> VHF and UHF signals while	<u>Case Report 1</u>: Malaise, lassitude, headaches, diarrhoea and parasthesiae in various bodyparts. Symptoms persisted in some of the subjects for up to 4 years. <u>Case Report 2:</u> 2 of the men suffered from	<u>Case Report 1</u>: Clinical tests showed that the CNS, the cardiovascular and the respiratory systems for all men were normal. Pinprick tests showed minor reductions in various bodyparts. <u>Case Report 2:</u> Clinical tests including	Dysaesthesia and neurological effects may persist after exposure.

	6 male engineers.	of a serious illness.	working on a TV antenna for 20 days (each man was exposed for a varying amount of hours per day). Max field strength of 194 V/m.	nausea and what they described as 'fuzzy head' but made a rapid and complete recovery. Another 2 of the men experienced severe symptoms which included nausea, headaches, lethargy, poor sleeping patterns and parasthesiae in various bodyparts. Symptoms persisted in some of the subjects for up to 4 years.	blood and biochemistry picture, urinary tract investigation and MRI were within normal levels. Neurological tests revealed slight impairments.	
Scott RS *et al* "Transient microwave induced neurosensory reactions during superficial hyperthermia treatment" *International Journal of Radiation Oncology, Biology and Physics*, Vol. 11, pp. 561-566, 1985.	200 cancer patients 10 of whom developed symptoms after hyperthermia treatment.	All patients had superficial malignancies.	915 MHz signals with an applicator for 30 min per session, 2 sessions per week for up to 12 sessions. Power densities started at 15 mW/cm^2 to higher values.	Dysaesthesia in nerves adjacent to the treated areas when exposed to RFR .	None	Once the symptoms were developed, they were associated with application of power without a time lag, and ceased at the instant of power removal. This latter characteristic implies that the symptom is a direct result of the MW field and not a thermal effect.

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