

Mobile Radiation Hazard

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Abstract: Mobile phone radiation and health concerns have been raised, especially following the enormous increase in the use of wireless mobile telephony throughout the world. These concerns exist because the antennas of these phones deliver much of their radiofrequency energy to very small volumes of the user's body. The interaction of the biological material with an electromagnetic source depends on the frequency of the source. Although hazards from exposure to high level (thermal) RF fields are established, no health hazards were associated with exposure to FR sources emitting field too low to cause significant rise in temperature. However the impact of regular use of mobile phone has raised concern about the potential health hazard. A second consideration is the power output of the transmitter, and its distance from the body. In this paper, an attempt has been made to explore the major harms of cell phone usage and accordingly suggestions for the safe usage have been proposed to minimize their impact on human health.

Index terms: Mobile phone radiation; Radiation absorption; Health effects.

1. INTRODUCTION

Wireless telephone systems operate in the radiofrequency (RF) portion of the electromagnetic spectrum. The exact frequency at which a handset operates depends on the company, the geographic location, and other factors. Most wireless telephone services operate at frequencies between 850 and 2000MHz, although other frequency ranges are coming into use as government set additional spectrum for wireless communications. The interaction of the biological material with an electromagnetic source depends on the frequency of the source. At extremely high frequencies characteristics of X-rays, electromagnetic particles have sufficient energy to disrupt the chemical bonds (ionization). This is how X-rays damage the genetic material of cells, potentially leading to cancer or birth defects. At lower frequencies such as RF radiations emitted by mobile phones, the energy of particle is too low to break chemical bonds. Therefore RF radiation is called non-ionizing radiation. As these radiations cannot break chemical bonds, the potential biological effects and hazards of non-ionizing and ionizing radiations are different.

2. HEALTH RISKS

2.1 Radiation absorption

Part of the radio waves emitted by a mobile telephone handset is absorbed by the human head. The exposure to RF energy on human body can be measured in several ways. For assessing exposure from transmitters located near the body, the most useful quantity is specific absorption rate (SAR). SAR is the measure of radiation absorbed in the body (either in a localized region of tissue or averaged over the whole body). As per data available on internet the radio waves emissions by a GSM handset, can have a peak power of 2 watts, and a US analogue phone had a maximum of 3.6 watts transmit power. Many Other digital mobile technologies, such as CDMA2000 and D-AMPS, use lower output power, typically below 1 watt, UVA. The maximum power output from a mobile phone is regulated by the mobile phone standard it is following and by the regulatory agencies in each country. In most systems the cell phone and the base station check reception quality and signal strength and the power level is increased or decreased automatically, within a certain span, to accommodate for different situations such as inside or outside of buildings and vehicles. The maximum SAR levels for modern handsets have been set by governmental regulating agencies in many countries. In the USA, the FCC has set a SAR limit of 1.6 W/kg, averaged over a volume of 1 gram of tissue, for the head. In Europe, the limit is 2 W/kg, averaged over a volume of 10 grams of tissue. SAR values are heavily dependent on the size of the averaging volume. Without information about the averaging volume used comparisons between different measurements cannot be made. Thus, the European 10-gram ratings should be compared among themselves, and the American 1-gram ratings should only be compared among themselves. SAR data for specific mobile phones, along with other useful information, can be found directly on manufacturers' websites, as well as on third party web sites.

2.2 Thermal effects

One of the effects of microwave radiation is dielectric heating, in which any dielectric material (such as living tissue) is heated by rotations of polar molecules induced by the electromagnetic field. Most of the heating effect will occur at the surface of the head, causing its temperature to increase by a fraction of a degree while using a cell phone. In this case, the level of temperature increase is an order of magnitude less than that obtained during the exposure of the head to direct sunlight. The brain's blood circulation is capable of disposing of excess heat by increasing local blood flow. However, the cornea of the eye does not have this temperature regulation mechanism and exposure of 2-3 hours' duration has been reported to produce cataracts in rabbits' eyes at SAR values from 100-140W/kg, which produced lenticular temperatures of 41°C. Mobile phones however, operate at power levels that are too far low to result in such thermal hazards.

Many scientific studies have investigated possible health effects of mobile phone radiation. These studies are occasionally reviewed by some scientific committees to assess overall risk. Some researchers have argued non-thermal effects that could be

reinterpreted as a normal cellular response to an increase in temperature. Glaser(2005) has stated that there are several thermoreceptor molecules in cells, and that they activate a cascade of second and third messenger systems, gene expression mechanisms and production of heat shock proteins in order to defend the cell against metabolic cell stress caused by heat. The increases in temperature that cause these changes are too small to be detected by studies such as REFLEX, which base their whole argument on the apparent stability of thermal equilibrium in their cell cultures. Karinen et al. (2008) reported that the mobile phone radiation might alter protein expression in human skin. Salford et al. (2008) have studied the effects of microwave radiation on the rat brain. They found a leakage of albumin into the brain via a permeated blood-brain barrier.

2.3 Mobile radiation and cancer

In order to investigate the risk of cancer for the mobile phone user, a cooperative project between 13 countries has been launched called INTERPHONE. The idea is that cancers need time to develop so only studies over 10 years are of interest. The following studies of long time exposure have been published. In 2006 a large Danish study about the connection between mobile phone use and cancer incidence was published. It followed over 420,000 Danish citizens for 20 years and showed no increased risk of cancer (Schuz et al., 2006)

A Swedish study by Lonn et al. (2005) concludes that the data do not support the hypothesis that mobile phone use is related to an increased risk of glioma or meningioma. Similarly, Schoemaker et al. (2005) suggests that there is no substantial risk of acoustic neuroma in the first decade after starting mobile phone use. However, an increase in risk after longer term use or after a longer lag period could not be ruled out. A joint study conducted in northern Europe by Lähkölä et al. (2007) reported that there is no increased risk of glioma in relation to mobile phone use, the possible risk in the most heavily exposed part of the brain with long-term use needs to be explored further before firm conclusions can be drawn. The INTERPHONE study group from Japan published the results of a study of brain tumour risk and mobile phone use. They used a new approach: determining the SAR inside a tumour by calculating the radiofrequency field absorption in the exact tumour location. Cases examined included glioma, meningioma, and pituitary adenoma. They reported that the overall odds ratio (OR) was not increased and that there was no significant trend towards an increasing OR in relation to exposure, as measured by SAR (Takebayashi et al., 2008).

In contrast, Dr. Lennart Hardell, (2007) from Örebro University in Sweden, reviewed published epidemiological papers (2 cohort studies and 16 case-control studies) and found that:

- Cell phone users had an increased risk of malignant gliomas.
- Link between cell phone use and a higher rate of acoustic neuromas.
- Tumors are more likely to occur on the side of the head that the cell handset is used.
- One hour of cell phone use per day significantly increases tumor risk after ten years or more.

Khurana (2008), presented an increasing body of evidence for a link between mobile phone usage and certain brain tumours and that it is anticipated that this danger has far broader public health ramifications than asbestos and smoking. A review by Hardell et al. (2009) concluded that current mobile phones are not safe for long-term exposure. Panagopoulos et al. (2004) found that there was reduction in reproductive capacity in fruit flies exposed to 6 minutes of 900 MHz pulsed radiation for five days.

2.4 Sleep and EEG effects

Sleep, EEG and waking rCBF have been studied in relation to RF exposure for a decade now, and the majority of papers published to date have found some form of effect. Most other papers have found significant effects on sleep (Borbély et al., 1999; Huber et al., 2000; Huber et al., 2002; Huber et al., 2005; Hung et al., 2007; Andrzejak et al., 2008). Luria et al. (2009) examined the effects of exposure to radiation emitted by standard GSM cell phones on the cognitive functions of humans. The study confirmed the existence of an effect of exposure on response times to a spatial working memory task, as well as the fact that exposure duration may play a role in producing detectable effects on performance.

2.5 Electromagnetic hypersensitivity

Some users of mobile handsets have reported feeling several unspecific symptoms during and after its use; ranging from burning and tingling sensations in the skin of the head and extremities, fatigue, sleep disturbances, dizziness, loss of mental attention, reaction times and memory retentiveness, headaches, malaise, tachycardia (heart palpitations), to disturbances of the digestive system. Reports have noted that all of these symptoms can also be attributed to stress and that current research cannot separate the symptoms from once effects (Roosli, 2008).

3. RESULTS AND DISCUSSION

In the present study we surveyed mobile phone users using a questionnaire based on symptoms for electromagnetic hypersensitivity. Out of the total 200 subjects surveyed, 152 were mobile phone users for more than 10 years. Rest 48 subjects were mobile phone users for less than 10 years. Only 8.3% (out of 48) of the subjects reported symptoms like headache, dizziness, heating effect, sleeplessness etc if they use mobile phone continuously for longer duration. Whereas 17.76% of the subjects (out of 152) reported, the occurrence of symptoms, like sleeplessness, headache and loss of mental attention. We conclude, keeping in view the above mentioned studies and our questionnaire based survey that although mobile phones provide great convenience and is important part of technological growth also. However, they emit RF radiations which can be harmful to human beings in long term, although the local SARs produced by mobile phones normally do not exceeds the safety limits. One should minimize the use of mobile phone as much as we can. One should also, avoid using mobile phone continuously for longer period and must maintain a gap between two uses. Mobile phones should not be kept close to the body. Hand free options such as wired headsets should be

used. Hands-free kits reduce the amount of energy exposure to the head because the antenna, which is the source of energy, is not placed against the head. Exposures decline dramatically when cell phones are used hands-free (FDA, 2009).

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