



RESEARCH ARTICLE

REVIEW ON HAZARDS OF RF-EMW IN MOBILE PHONE USERS

*¹Dr. Pratibha Singh Oswal and ²Dr. Mayur Oswal

¹Department of Oral Pathology and Microbiology, D.Y. Patil Dental School, Lohegaon, Pune, India

²Department of Conservative Dentistry, D.Y. Patil Dental School, Lohegaon, Pune, India

ARTICLE INFO

Article History:

Received 29th December, 2015

Received in revised form

17th January, 2016

Accepted 15th February, 2016

Published online 16th March, 2016

Key words:

Micronuclei,
Electromagnetic radiation,
Electromagnetic neutralizer.

ABSTRACT

In the modern day life, mobile phones have become an integral part of mutual communication. Today there are more than two billion cell phone users being exposed every day to the dangers of electromagnetic radiation (EMR)—dangers government regulators and the cell phone industry refuse to admit exist. Included are: genetic damage, brain dysfunction, brain tumors, and other conditions such as sleep disorders and headaches. The amount of time spent on the phone is irrelevant, as the danger mechanism is triggered within seconds. This article highlight on hazards of electromagnetic radiation by using mobile phone.

Copyright © 2016 Dr. Pratibha Singh Oswal. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Dr. Pratibha Singh Oswal and Dr. Mayur Oswal, 2016. "Review on hazards of rf-emw in mobile phone users", *International Journal of Current Research*, 8, (03), 27370-27373.

INTRODUCTION

The health effects of radiofrequency electromagnetic waves (RF-EMW) emitted from cell phones have been debated greatly (WHO, 2006; Makker *et al.*, 2009). Researchers initially were concerned about how microwave radiation affected human biological systems by increasing tissue temperature--in other words, its thermal effects (Ofstedal *et al.*, 2000). To protect the public from excessive exposure to RF-EMW, limits were established by international organizations such as the ICNIRP (International Commission on Non Ionizing Radiation Protection) [4]. For example, the limit of radiation exposure from a mobile phone in the United States and Europe is 1.6 Watts/kg and 2.0 Watts/kg, respectively (WHO, 2006; ICNIRP, 1998). Recent studies demonstrated microwaves emitted from the cell phone, i.e., RF-EMW do not produce thermal effect at specific absorption rate (SAR) of 1.6 Watts/Kg (Anderson and Rowley, 2007; Straume *et al.*, 2005; Sivasankari *et al.*, 2008). Micronucleus (MN), a microscopically visible round or oval cytoplasmic chromatin mass in the extra nuclear vicinity, originates from aberrant mitosis and consists of eccentric chromosomes, chromatid fragments or whole chromosomes, which have failed to reach spindle poles during mitosis.

MN has been used consistently as a biomarker for assessment of DNA damage (Sivasankari *et al.*, 2008). Since 1937 micronuclei have been regarded as indicators for genotoxic exposure. Clinical studies show that the determination of the MN rates in different cytological preparations can be reproducible. The loss of chromatin in the main nucleus due to a mutagenic exposition, contributes to the formation of micronuclei (Bloching *et al.*, 2008).

How does mobile phone affect human tissues?

The possible pathways of carcinogenesis by RFEMW the plasma membrane may be a target its might trigger uncontrolled cell proliferation by its action on various plasma membrane enzymes and receptors. Short-term exposure to RF-EMW can lead to increase in the activity of plasma membrane NADH oxidase enzyme, which increases ROS formation (Friedman *et al.*, 2007). The ROS then activates MMPs (matrix metalloproteinases), which would release epidermal growth factor and activate extracellular signal regulated kinases (ERKs). Chronic exposure to RF-EMW induces stress kinases, which activate p38 MAP (mitogen activated protein) kinase. P38 MAP kinase stimulates phosphorylation of heat shock proteins, which inhibit the apoptosis pathway. Moreover, various reports have suggested that ODC maybe a target for microwave radiations (Hoyto *et al.*, 2007; Behari and Paulraj,

*Corresponding author: Dr. Pratibha Singh Oswal,
Unnati Heritage, Pune, India.

2007; Byus *et al.*, 1988). ODC is the rate limiting enzyme that participates in polyamine synthesis; compounds required for cell division. Over expression of ODC is linked to progression of cancer (Hornia *et al.*, 1999). ODC activity is modulated by membrane-mediated signals, and RF-EMW might stimulate ODC directly or through its action on the membrane. (Byus *et al.*, 1988). Although RF-EMW exposure is known to affect PKC isoenzyme expression, the literature contains controversial reports regarding the role of change in PKC activities in carcinogenesis (Hornia *et al.*, 1999; Griner and Kazanietz, 2007). Phorbol ester is a widely known tumor-promoting agent, and acute exposure to phorbol ester stimulates PKC. However, chronic exposure to phorbol ester decreases the activity of PKC delta. Lu *et al* and Hornia *et al* found that depletion of PKC delta was associated with tumor promotion (Hornia *et al.*, 1999; Lu *et al.*, 1997). As we discussed above, RF-EMW might be associated with a decline in PKC activity. Thus, we suggest that chronic RF-EMW exposure leading to declines in PKC activity might be associated with carcinogenesis. Changes in intracellular calcium levels and activities of ODC and PKC are interrelated as well as can be secondary to RF-EMW exposure. The literature also contains a report of ROS-mediated changes in the activities of PKC and ODC (Otieno and Kensler, 2000). Thus, RF-EMW mediated increases in ROS production can trigger cell differentiation by its action on MAPK kinase, hsp, PKC and ODC.

Mobile users are advised to take precautionary measures while using a mobile handset as

- Keep distance – Hold the cell phone away from body to the extent possible.
- Use a headset (wired or Bluetooth) to keep the handset away from your head.
- Do not press the phone handset against your head. Radio Frequency (RF) energy is inversely proportional to the square of the distance from the source -- being very close increases energy absorption much more.
- Limit the length of mobile calls.
- Use text as compared to voice wherever possible.
- Put the cell phone on speaker mode.
- If the radio signal is weak, a mobile phone will increase its transmission power. Find a strong signal and avoid movement – Use your phone where reception is good.
- Metal & water are good conductors of radio waves so avoid using a mobile phone while wearing metal-framed glasses or having wet hair.
- Let the call connect before putting the handset on your ear or start speaking and listening – A mobile phone first makes the communication at higher power and then reduces power to an adequate level. More power is radiated during call connecting time.
- If you have a choice, use a landline (wired) phone, not a mobile phone (<http://www.next-up.org>). Possible solutions to reduce the ill effects of cell phone radiation:

EMF Neutralizer neutralize the harmful effects of radiation emitted by mobile phones and all other electronic devices such as cordless phones, smart meters and WiFi routers. Use one disc per device. Does not interfere with reception

How does it Work?

The Neutralizer contains a unique blend of natural activated rare Earth elements [paramagnetic and diamagnetic] that creates a natural harmonious energy field. When placed on a mobile phone or other electronic device, this natural harmonious energy pattern overlays and interacts with the human-made chaotic energy pattern and neutralizes it, so it becomes harmless to the human body. Noted DNA researcher Dr. Glen Rein of Quantum Biological Lab, completed a study in which he concluded:... the natural coherent energy emanating from Aulterra Neutralizer mitigated the incoherent energy from the man-made EMF, rendering it harmless to human DNA (www.theneutralizer.com)."

DISCUSSION

Mobile phone (cell phone) use is increasing extraordinarily rapidly worldwide. There are now 4.6 billion mobile phone subscribers worldwide. Users of mobile phones are exposed to electromagnetic radiation, which has long been hypothesized to have adverse health effects, including increased risk of cancer (International Telecommunication Union, 2010; International Agency for Research on Cancer, 2002). The effects of these damages reflected by MN may lead to the development of pre-cancer and cancer. Thus, MN assessment and a high index would presuppose predisposition of the individual to the development of these changes. The MN assay in exfoliated buccal cells is a useful and minimally invasive method for monitoring genetic damage in humans (National Research Council, 1997).

Chromosomal damage by EMR in dividing basal cells of the epithelium results in the production of micronuclei in the daughter cells that migrate up through the epithelium and are exfoliated Mn arise in mitotic cells from chromosomal fragments or chromosomes that lag behind in anaphase and are not integrated in to daughter nuclei. Mn harboring chromosomal fragments may result from: direct DNA breakage, or replication on a damaged synthesis. Mn harboring whole chromosomes is primarily formed from failure or the mitotic spindles, Kinetochore, or other parts of the mitotic apparatus alterations in cellular physiology and mechanical disruption. There an increased frequency of MN cells is a biomarker of genotoxic effects that can reflect exposure to agents with clastogenic or aneugenic modes of action. A significant increase in the MN in mobile users was found compared with non-mobile users indicating the genotoxic effect of EMR (Kashyap *et al.*, 2012). Rekhadevi *et al* showed that MN count was double in the mobile users as compared with non-mobile users with high statistical significance, which is in accordance with our results (Gandhi, 2005).

Conclusion

We conclude this study indicated that the frequencies of micronuclei cells in mobile users are significantly increased, as compared to non user and reviewed the literature to better understand the effects of cell phone radiation on human health, especially on fertility and in relation to cancer. The data highlights the potential dangers of prolonged exposure to radiofrequency radiation used in mobile phones with requires widespread caution (Rekhadevi, 2009).¹⁷ Today the radiation

effects are well proved and the standard of radiation, used in different countries, does not ensure safety. So the tolerable limits of EMR should be decreased to avoid a serious health hazard and while making the standards the governing bodies should take into account the long term effects of electromagnetic radiations.

REFERENCES

- Anderson, V. and Rowley, J. 2007. Measurements of skin surface temperature during mobile phone use. *Bioelectromagnetics*, 28(2):159-162.
- Behari, J. and Paulraj, R. 2007. Biomarkers of induced electromagnetic field and cancer. *Indian J Exp Biol*, 45(1):77-85.
- Blank, M. 2005. Do electromagnetic fields interact with electrons in the Na, K-ATPase? *Bioelectromagnetics*, 26(8):677-683.
- Bloching, M., Reich, W., Schubert, J., Grummt, T. and Sandner, A. 2008. Micronucleus rate of buccal mucosal epithelial cells in relation to oral hygiene and dental factors. *Oral Oncol.*, 44:220-6.
- Byus, C.V., Kartun, K., Pieper, S., Adey, W.R. 1988. Increased ornithine decarboxylase activity in cultured cells exposed to low energy modulated microwave fields and phorbol ester tumor promoters. *Cancer Res.*, 48(15):4222-4226.
- Capri, M., Scarcella, E., Fumelli, C., Bianchi, E., Salvioli, S., Mesirca, P., Agostini, C., Antolini, A., Schiavoni, A., Castellani, G., Bersani, F. and Franceschi, C. 2004. In vitro exposure of human lymphocytes to 900 MHz CW and GSM modulated radiofrequency: studies of proliferation, apoptosis and mitochondrial membrane potential. *Radiat Res.*, 162(2):211-218.
- Cleary, S.F., Du, Z., Cao, G., Liu, L.M., McCrady, C. 1996. Effect of is other malradiofrequency radiation on cytolytic T lymphocytes. *FASEBJ*, 10(8):913-919.
- Friedman, J., Kraus, S., Hauptman, Y., Schiff, Y. and Seger, R. 2007. Mechanism of short-term ERK activation by electromagnetic fields at mobile phone frequencies. *Biochem J.*, 405(3):559-568.
- Gandhi, G. 2005. Genetic damage in mobile phone users: Some Preliminary findings. *Indian J. Hum. Genet.*, 11:99-104
- Griner, E.M. and Kazanietz, M.G. 2007. Protein kinase C and other diacylglycerol effectors in cancer. *Nat Rev Cancer.*, 7(4):281-294.
- Hornia, A., Lu, Z., Sukezane, T., Zhong, M., Joseph, T., Frankel, P., Foster, D.A. 1999. Antagonistic effects of protein kinase C alpha and delta on both transformation and phospholipase D activity mediated by the epidermal growth factor receptor. *Mol Cell Biol.*, 19(11):7672-7680.
- Hoyto, A., Juutilainen, J. and Naarala, J. 2007. Ornithine decarboxylase activity is affected in primary astrocytes but not in secondary cell lines exposed to 872 MHz RF radiation. *Int J Radiat Biol.*, 83(6):367-374. <http://www.next-up.org>.
- International Agency for Research on Cancer. Non-ionizing Radiation, Part 1: Static and Extremely Low-frequency (ELF) Electric and Magnetic Fields. IARC Monograph 80. Lyon: International Agency for Research on Cancer, 2002.
- International Commission on Non-Ionizing Radiation Protection (ICNIRP): Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300GHz). International Commission on Non-Ionizing Radiation Protection. *Health Phys* 1998, 74(4):494-522.
- International Telecommunication Union. Measuring the Information Society. 2010. Geneva: International Telecommunication Union.
- Kashyap Bina, Padala Sridhar Reddy. Micronuclei assay of exfoliated oral buccal cells: Means to assess the nuclear abnormalities in different diseases. *JCRT*, 2012; 2: 184-191.
- Lai, H., Singh, N.P. 1996. Single- and double-strand DNA breaks in rat brain cells after acute exposure to radiofrequency electromagnetic radiation. *Int. J. Radiat Biol.*, 69(4):513-521.
- Lantow, M., Lupke, M., Frahm, J., Mattsson, M.O., Kuster, N., Simko, M. 2006. ROS release and Hsp70 expression after exposure to 1,800MHz radiofrequency electromagnetic fields in primary human monocytes and lymphocytes. *Radiat Environ Biophys*, 45(1):55-62.
- Leszczynski, D., Joenvaara, S., Reivinen, J. and Kuokka, R. 2002. Non-thermal activation of the hsp27/p38MAPK stress pathway by mobile phone radiation in human endothelial cells: molecular mechanism for cancer- and blood-brain barrier-related effects. *Int J Radiat Biol*, 70(2-3):120-129
- Lixia, S., Yao, K., Kaijun, W., Deqiang, L., Huajun, H., Xiangwei, G., Baohong, W., Wei, Z., Jianling, L. and Wei, W. 2006. Effects of 1.8 GHz radiofrequency field on DNA damage and expression of heat shock protein 70 in human lens epithelial cells. *Mutat Res.*, 602(1-2):135-142.
- Lu, Z., Hornia, A., Jiang, Y.W., Zang, Q., Ohno, S., Foster, D.A. 1997. Tumor promotion by depleting cells of protein kinase C delta. *Mol Cell Biol.*, 17(6):3418-3428.
- Makker, K., Varghese, A., Desai, N.R., Mouradi, R. and Agarwal, A. 2009. Cellphones: modern man's nemesis? *Reprod Biomed Online*, 18(1):148-157.
- McNamee, J.P., Bellier, P.V., Gajda, G.B., Lavallee, B.F., Marro, L., Lemay, E. and Thansandote, A. 2003. No evidence for genotoxic effects from 24 hr exposure of human leukocytes to 1.9 GHz radiofrequency fields. *Radiat Res*, 159(5):693-697.
- National Research Council. Possible Health Effects of Exposure to Residential Electric and Magnetic Fields. Washington, DC: National Academy Press, 1997.
- Oftedal, G., Wilen, J., Sandstrom, M. and Mild, K.H. 2000. Symptoms experienced in connection with mobile phone use. *Occup Med (Lond)*, 50(4):237-245.
- Otieno, M.A. and Kensler, T.W. 2000. A role for protein kinase C-delta in the regulation of ornithine decarboxylase expression by oxidative stress. *Cancer Res.*, 60(16):4391-4396.
- Rekhadevi, et al. 2009. Gene toxicity evaluation of human populations exposed to radiofrequency radiation. *Toxicol. Int.*, 16:9-19.
- Sivasankari, N.P., Kaur, S., Reddy, K.S., Vivekanandam, S., Rao, K.R. 2008. Micronucleus index: An early diagnosis in oral carcinoma. *J. Anat. Soc. India*, 57:8-13.

Straume, A., Oftedal, G. and Johnsson, A. 2005. Skin temperature increase caused by a mobile phone: a methodological infrared camera study. *Bioelectromagnetics*, 26(6):510-519.

World Health Organization (WHO): 2006. WHO research agenda for radio frequency fields. 2006. www.theneutralizer.com
