

MOBILE PHONE USE AND ORAL HEALTH

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ABSTRACT

Over the past decade, the use of cell phones has increased significantly. Total cell phone subscriptions amounted to more than 6 billion in recently, corresponding to a global penetration rate of 93.1% per 100 inhabitants. The rapid worldwide increase in cell phone users has raised health concerns about potential risks produced by this technology. Given the large number of cell phone users, a negative effect may have huge public health implications including Oral Health. This review of literature brings into the light the harmful effects of these radiations and also to make the people aware of possible oral health problems that can arise as a result of over - usage of mobile phones.

KEYWORDS: Mobile phone; radiations; oral health

INTRODUCTION

In the last two decades, the use of mobile phones has increased enormously all over the world. We mainly use mobile phones for calls and messages, but data transfer, music, games, and other applications are becoming increasingly popular, especially among young people. This technology is based upon electromagnetic radiation in the microwave frequency range [radiofrequency (RF) waves and microwaves]. The radiation frequency and modulation standards vary in the range of 300– 2100 MHz, depending on the region in the world. The most important second generation standard is the Global System for Mobile Communication (GSM), which uses frequencies of around 900 and 1800 MHz. Epidemiological studies have suggested that exposure to the low

energy, ultra-high-frequency electromagnetic field (UHF-EMF) emitted by a mobile phone may have biological effects in living organisms, though at present no definitive association can be obtained to the incidences of cancer or to other genetic and non-genetic pathological conditions. Most investigations have been unable to confirm increased risk.¹⁻⁴ The World Health Organization (WHO) has recently recommended investigating the effects of exposure to electromagnetic radiations (EMRs) from mobile phone base stations to address public concerns.⁵

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One well-understood effect 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 EMF. Studies indicate that the population residing near mobile phone base stations complain of nonspecific symptoms of ill-health such as headache and sleep disturbances. Premature cataracts have not been linked with cell phone use, possibly because of the lower power output of cell phones.^{6,7} The radiofrequency EMFs from base station leads to impaired cognitive functions including ill effects on general as well as oral health. Saliva modulates the ecosystem within the oral cavity, thus playing a crucial role in maintenance of oral homeostasis.⁸ The other functions include lubrication of the bolus, protection and repair of the oral mucosa, buffer capacity, and dental remineralization.⁹ The

quantitative or qualitative alterations in salivary secretion may lead to caries, oral mucositis, candidiasis, oral infections, dysphagia and halitosis¹⁰ The buffer capacity of saliva depends on the bicarbonate content.¹¹ Decreased salivary flow rate tends to increase the risk of caries development.¹² It is also observed that people living in the vicinity of base stations had various complaints mostly of sleep disturbances, irritability, depression, blurred vision, concentration difficulties, nausea, lack of appetite, headache, and vertigo.¹³ The potential health effects cannot be restricted to mobile phone base station frequency bands alone. It can also be attributed to exposure due to other sources of radiofrequency Electromagnetic radiations in daily life such as mobile phones, cordless phones, and wireless local area networks.^{14, 15} The rapid growth in the number of cell phone users has raised questions about possible biological effects of the radiation emitted by these appliances. The oral mucosa is located within an area exposed to radiation emitted by cell phones; therefore, it is important to investigate its effects on oral mucosal cells. The findings of this study suggest that long-term exposure to cell phone radiation can slightly increase the frequency of cytogenetic abnormalities, such as micronuclei, broken eggs, and exfoliated oral mucosal binucleated cells. A group of researchers studying the micronucleus assay denominated The Human Micronucleus Project on Exfoliated Buccal Cells (HUMN_{XI}) made a worldwide survey on studies reporting micronucleus frequency in 30 different laboratories and estimated that spontaneous MN frequency of subjects not exposed to genotoxic chemical agents or radiation was 0.74‰ (95%CI 0:52 to 1:05)¹⁶ Although an increase in nuclear abnormalities was observed, the mean of MN is still lower than that found in patients with potentially malignant carcinomas. Pelliccioli *et al.*¹⁷ used a similar methodology and observed that the MN median was 1 per 1,000 cells for patients with leukoplakia and 2 per 1,000 cells for patients with squamous cell carcinomas. Therefore, that demonstrates that, despite a significant increase in micronuclei in individuals who use their cell phones for a longer time, the radiation emitted by the appliances is within acceptable physiological limits. To date, the literature on this topic has been contradictory, and a literature review encountered five studies about

the effects of radiation emitted by cell phones on the oral mucosa, which yielded contrasting results. Yadav and Sharma¹⁸ found an increased frequency of micronucleated exfoliated cells in 85 cell phone users compared to 24 non-users (controls). Gandhi and Prabhjot¹⁹ also found a positive correlation between the number of micronuclei and increasing exposure to cell phone radiation, comparing 25 users with 25 controls. Souza *et al.*²⁰ did not find any correlation between micronuclei and radiofrequency exposure; however, this study reports an increase of broken eggs in the group with greater exposure. The oral mucosa shows different degrees of keratinization according to the anatomical site; for example, the lip demonstrates greater keratinization compared to the tongue and to the floor of the mouth,²¹ but even with these different patterns, our results showed statistically significant differences at all sites analyzed; furthermore, we conducted this investigation on anatomical sites where oral cancer is more prevalent: lower lip, border of the tongue, and floor of the mouth.²² The differences between our results and those of other studies may be in part explained by the different sites analyzed, as the sites we assessed are likely more susceptible to cytogenetic alterations.²³ By comparing the changes by anatomical site, we found that the lower lip had a higher mean of broken eggs and binucleated cells. This data indicates that such a site has the largest cellular repair compared to the other ones. Another possible explanation is that it is exposed to external agents such as solar radiation and, in addition, the studied local site is closest to the physically electromagnetic radiation source. The border of the tongue had more karyorrhectic cells than did the other sites. Such cytogenetic damage is explained when the cell cannot reverse the damage, being thus eliminated from the body, suggesting that the oral mucosa may present different ways to adapt to the same stimulus.²⁴ Regarding all the nuclear modifications studied, the floor of the mouth had the lowest averages, which suggests that it would be the most protected site from cell phone radiation, with the buccal mucosa and tongue acting as physical and biological barriers. It is also important to highlight that different staining techniques were used. Yadav and Sharma¹⁸ used orcein, which is not a DNA-specific stain and thus might not only stain DN containing micronuclei, but also other

artifacts that are not associated with genomic instability, which can explain the very high number of micronuclei. There are two known possible effects of the mobile energy on the human body – thermal and non-thermal. The heating of biological tissue is a result of microwave energy absorption by the water content of the tissues.²⁵ Changes have been found changes in the salivary secretion and protein concentration because of MPH (Handheld mobile phones) use.²⁶ Bhargava *et al.*²⁷ carried out a study to check the functional and volumetric changes in the parotid glands among mobile users. Modified Schirmer test was used for heavy users and control groups, and ultrasonography was performed to check the gland volume. It was found out that there was a significant increase in the salivary flow rate and blood flow, especially on the side where the mobile phone was placed. A significant enlargement in the parotid gland volume was also seen on the affected side. The effects on health by mobile radiations have been subject of debate for a long time. Mobile phones emit electromagnetic radiations in the microwave range (300 MHz [0.3 GHz] and 300 GHz). According to International Agency for Research on Cancer, the mobile radiations are classified as Group-2B - possibly carcinogenic radiations i.e. there “could be some risk” of carcinogenicity.²⁸ At the same time, WHO has stated that “to date, no adverse health effects have been established as being caused by mobile phone use.”²⁹ The heating caused by the mobile phone mainly occurs in the head and neck region which is neutralized by the brain’s blood circulation, but cornea of the eye does not have any temperature regulation and as a result, an exposure of 2-3 h can be harmful. However, further research is required in this field.1 The longitudinal studies carried out have shown that there is no risk of meningiomas and gliomas in the head and neck region associated with mobile phone usage.²⁹ A study conducted in Sweden suggested that by using a mobile phone for more than 10 years had an increased risk of acoustic neuromas, which is a type of benign brain tumor.³⁰ Many countries such as Austria, France, Germany and Sweden have recommended measures to minimize the mobile radiation exposure. The various steps taken to achieve this are: Use hands-free to decrease the radiation to the head, keep the mobile phone away from the body and not to use the telephone in a car without

an external antenna. Several nations have also advised moderate use of mobile phones for children.³¹

CONCLUSION

The number of mobile users worldwide is above 6,800,000,000 which are further increasing at a very fast rate. India stands second with over 900 million users in the world. The fact is that mobile phones are used at an enormous number by all the age-groups in today’s scenario. It has been noted that the average person spends 90 min a day on their phone. It can be concluded that though there have been no clear effects of mobile radiations on teeth and buccal mucosa but changes in the saliva and parotid gland have taken place. Hence, further research is required in this field to bring into the light the harmful effects of these radiations and also to make the people aware of possible oral health problems that can arise as a result of over - usage of mobile phones. Risks can also be attributed to exposure due to other sources of radiofrequency Electromagnetic radiations in daily life including cordless phones, and wireless local area networks and mobile phone base station frequency bands. It is a raised public concern and requires extensive studies and interest.

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