

## Hair Loss due to Electromagnetic Radiation from Overuse of Cell Phone

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### Abstract

Mobile phone usage is nearing 90% of the world population. Harmful effects of Electromagnetic (EMG) radiation have been a concern for regulation. Safe Specific Absorption Rate (SAR) as watt/kg is defined for thermal effects, but EMG has non thermal effects as well. EMG can affect genes, neural tissue, endocrine regulation and sperms. Research workers have pointed out the mechanism of EMG radiation to be acting through DNA breakage and formation of Reactive Oxygen Species (ROS). We are reporting a case of hair loss over the temporal region from repeated, prolonged conversations on mobile phone. Biopsy is negative for any other pathology of hair loss. Use of antioxidants, vitamins, minerals, can aid in recovery of the damaged cells. Low dose 2% minoxidil application combined with nutritional therapy, limiting the duration of mobile phone usage and having hands free chord to keep the mobile phone instrument away from the ear, was seen to help in regrowth of the hair.

**Keywords** Hair loss; Mobile phone; Cell phone; Electromagnetic waves; Radiation; DNA breakage; Reactive oxygen species; Vitamins; Nutritional correction

### Introduction

Out of 7 billion population on earth, 5.28 billion were mobile phone users in 2010 [1]. In 2007 the Mobile Telecommunications and Health Research Program (MTHR) investigated health effects of mobile phone radiation and ruled out cancer risk [1]. Energy absorbed by the body from mobile phones is measured as Specific Absorption Rate (SAR). GSM handsets emit electromagnetic waves (EMG) of 2 watts, Analog phones emit 3.6 watts, CDMA and [2] digital handsets emit radiation of 1 watt. Phone manufacturers must comply with SAR 1.6 w/kg in USA and SAR 2 w/kg in UK. There are also non thermal and cumulative effects from EMG. Researchers have described EMG effects to be genotoxic, neuronal, cardiovascular, endocrine, affecting sperm counts and sperm quality as well [2]. Electro-hypersensitivity is a newly recognized functional impairment [3]. This case report describes a patient of hair loss around the left temporal and parietal area due to continuous prolonged use of mobile phone. The mechanism of DNA breakage [4-6] and Reactive Oxygen Species (ROS) [7-9], in hair loss from exposure to mobile radiation is described. The same is confirmed from clinical improvement seen after use of antioxidants, vitamins and minerals along with 2% minoxidil topical application for hair growth.

### Case Report

A 46 year male patient, presented with an unusual area of hair loss around the left ear. On examination there was an area of hair loss and thinning over the left temporal angle (Figure 1). The hair was fragile, but could not be pulled out easily, thinner slow growing hair were seen on the base of the scalp, no scaling or redness. The thinning had gradually developed over past 6 months. No similar lesions were seen on scalp, no loss of eyebrows or body hair. Patient had grade V of male pattern baldness developing gradually over past 10-15 years and he was not concerned about the baldness. He had never taken any treatment

for the baldness. The asymmetrical loss of hair on a defined area made him uncomfortable. Details of personal history revealed that patient was a wholesale business trader, buying and selling commodities. There was history of at least 18-20 business conversations of more than 20 minutes duration every day for past 9-10 months. Patient had history of prolonged cell phone talk with continuous long conversations holding the phone pressed in place between the left [3] shoulder and the ear by bending the neck completely to the left and lifting the left shoulder upwards to hold the phone. The area of hair loss and thinning corresponded to the tilted position of the mobile phone when it was held between the left ear and the shoulder. It was suspected weather mobile phone radiation had caused the hair loss.



**Figure 1:** Hair thinning around the left ear from holding cell phone 6-7 hours a day.

### Trichoscopy

The affected area had thin slow growing hair over the scalp confined to the lesion while good thick terminal hairs were seen at the margins.

There was no intermediate zone or border of partially miniaturized hair that would be gradually leading to good terminal hair. No anisotrichosis, no peri follicular reaction, no pigmentation, scaling, no broken hair or exclamation mark hair were seen (Figure 2). A biopsy was conducted to explore and understand the pathology.



**Figure 2:** Thin slow growing hair over affected area with adjacent good terminal hair along the margins, no peri-follicular reaction.

### Histopathology

Biopsy showed mast cell infiltration in upper layers of the skin, suggesting skin reaction but there was no specific concentration of cellular infiltration around the dermal papilla or the hair follicle. The findings were reported as indicative of prolonged exposure to an irritant or antigen. Biopsy did not indicate alopecia areata, cicatricial alopecia or androgenetic alopecia, these possibilities were ruled out.

### Treatment and Result

Review of literature showed that DNA breakage [4-6] and generation of ROS [7-9] play a role in slowing down of hair growth and hair loss from exposure to mobile radiation [4].



**Figure 3:** Improved hair growth within 4 months after changing to hands free and antioxidant therapy.

Treatment was planned to stimulate the slow growing hair with twice a day application of minoxidil 2%. Antioxidants were used to neutralize the generation of ROS. Nutrients including iron, calcium, amino acids, Biotin, Vitamin C, B-Complex and Omega 3 were added to aid in recovery of cell damage and support rapid cell division required for new hair growth. Since use of multiple nutrients together can interfere with individual efficiency these were administered in a three day cycle as published earlier by the author [9-11]. Patient was advised to reduce cell phone conversation time and use a hands free ear phone with mice chord to avoid contact with the area of hair thinning around the left ear. Within two months there was commencement of hair regrowth and by 4 months there was complete regrowth of the affected temporal angle plus appreciable new hair growth in all the surrounding areas as well (Figure 3).

### Discussion

#### Hair loss from exposure to mobile phone radiation by DNA breakage

Cam and Seyhan (2012) collected hair samples from healthy men, immediately before and after using a 900-MHz GSM (Global System for Mobile Communications) mobile phone for 15 and 30 min. Single-strand DNA breaks of hair root cells from the samples were determined using the 'comet assay'. They found significant increase in DNA single-strand breaks in human hair root cells located around the ear where the phone was held [4]. The same was experimentally demonstrated by Phillips and Singh in 2008 [5]. While Schwarz et al. had shown it in lab studies that single strand DNA breakage was a non-thermal effect and short intermittent exposure caused stronger damage than continuous exposure [6]. These studies formed the basis of advising use of hands free cord and reducing conversation time on the mobile phone to help in restoration of lost hair [5].

#### Hair loss from exposure to mobile phone radiation through ROS

Gnitecki et al. showed reduced Superoxide Dismutase (SOD) activity in blood platelet samples after exposure to mobile phone radiation [7]. Mollaoglu et al. found reduced SOD as well as rise in lipid peroxidation caused by 900 MHz mobile radiation [8]. These studies formed the basis of using antioxidants, vitamins, minerals in addition to 2% minoxidil for supporting rapid cell division, regeneration and regrowth of the lost hair.

#### Genotoxic and hormonal effects of mobile phone radiation can also lead to hair loss

Hair growth is result of a dynamic balance between factors that promote and inhibit hair growth. Singh et al. have reviewed thermal and non-thermal genotoxic effects of cell phone radiation, damaging and altering activity of genes and chromosomes [2,12]. Singh et.al documented various complaints associated with mobile radiation effects as fatigue, sleep disturbance, dizziness, lack of concentration, ringing in the ears, reaction time, loss of memory, headache, disturbance in digestive system and heart palpitation including hair loss in 8% of the cases [2]. The incidence discovered may have been higher if their study was focused on hair loss and poor hair growth. Toutou et al. [13] and the studies of Sumedha et al. [14] concluded that GSM-900 cellular telephones affects the circadian patterns of gonadal, adrenal and pituitary hormones, elevate estrogen, reduce

tesosterone, melatonin leading to insomnia [2,12-14]. All these hormones affect the human hair cycles. Studies by the Centre for Reproductive Medicine in Cleveland, U.S., have found that sperm cells were affected at just one tenth of the safe SAR threshold [2,12]. In addition to causing hair loss, mobile phone radiation can create hormonal imbalance, disturb the hair growth regulation and affect other systems in the body leading to secondary hair loss.

## Conclusion

Exposure to cell phone radiation can lead to hair loss by single strand DNA breakage, genotoxic effect, generation of ROS and altered hormonal regulation. Use of antioxidants, vitamins, minerals, can aid in recovery of the damaged cells. Low dose 2% minoxidil application combined with low dose comprehensive nutritional therapy, limiting mobile phone usage and keeping the mobile phone instrument away from the ear, helps in complete regrowth of the hair. We have seen increased incidence of hair loss in call center professionals and software developers, but it remains to determine whether this is due to prolonged exposure to computer screens.

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