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EFFECT OF MOBILE PHONE RADIATION ON TYMPANIC TEMPERATURE

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ABSTRACT

The paper assesses the influence of electromagnetic radiation produced by mobile phone on tympanic Temperature of healthy persons using instant thermometer Thermo Scan. The ear temperature was measured directly and instantly in healthy persons (both Females and males) totaling 20 in number in their relaxed condition and also immediately after the use of mobile phone in talk mode for 30 min. The subjects were of age group ranging from 18 to 50 years. It is interesting note from the data that there is no way any significant change in tympanic temperature before and immediately after the use of mobile phone.

KEYWORDS: Mobile phone, Electromagnetic radiation, Temperature, Ear cannel, Instant thermometer.

INTRODUCTION

Mobile phones emerged as an apparatus of luxury in the early 90's, but presently it has become an inevitable part of daily life for a human being. At present there are nearly 7 billion mobile subscriptions worldwide according to The International Telecommunication Union. This is equivalent to 95.5% of the population [1]. Widespread utilization of mobile communication systems has caused great concern about the probable health effects caused by the radio frequency (RF) fields emitted from cell phones [2].

RF radiation can cause the heating of tissues that leads to an increase in the body temperature. This is known as the thermal effect. Although the body has its effective ways of regulating its temperature, nevertheless, if the RF exposures are too high, the body may no longer be able to cope. For thermal effects, the rate at which energy is absorbed per unit of biological tissue is known as the 'specific absorption rate' (SAR) in other word, it is measured in watts per kilogram.

Concerns have been raised associated with the temperature rise in head and brain tissues due to the use of mobile phones which has led to significant research work on this subject. Simple [3 - 4] or more complex thermal models [5 - 6] and investigation on the temperature variation on skin in the right outer ear (Concha) [7] and other previous studies show the possible biological effects arising from the use of mobile phones can be regarded as a result of energy absorbed by the head that may affect the brain and nervous system tissue [8 - 9].The RF fields emitted from mobile phones penetrate the exposed tissues producing heat. This thermal effect can cause harm by increasing body temperature, and damaging biological tissue, particularly those of head and brain [10].
In this paper an attempt has been made on thermal effects of electromagnetic radiation produced by mobile phone (Nokia X2 – 02). The network technology of which is GSM 900/1800. The Specific Absorption Rate (SAR) is 0.91 W/kg when closed to head or ear on human. In order to find the temperature of tympanic membrane (ear drum) or ear canal an instant thermometer, *thermo scan* is used.

MATERIAL AND METHODS

The ear temperature was measured directly and instantly in healthy persons (both Females and males) totaling 20 in number in their relaxed condition and also immediately after the use of mobile phone in talk mode for 30 min. The subjects were of age group ranging from 18 to 50 years. The equipment called instant thermo meter was used for the detection and measurement of ear temperature(Fig.1.).

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Fig.1. Instant Thermometer

Any material object with a temperature above absolute zero emanates thermal electromagnetic waves from its surface. The cooler the object, the longer the electromagnetic waves and the less energy they carry. The warmer the object, the shorter the distance between the electromagnetic wave ripples and the more energy the waves carry. The energy emanated from surrounding objects and from our bodies varies with temperature. The radiation carries relatively low energy and is absolutely harmless. The wavelengths (4 μm and longer) of this energy are longer than the longest waves that one can see, which are seen as the color red. That is why the radiation is called infrared (meaning below red). Because the infrared energy radiating from an object varies with the temperature of that object, one can measure this energy and calculate temperature of the 35 object. The PRO-LT Instant Thermometer is designed on this principle. It measures the temperature of the tympanic membrane(a documented indicator of core body temperature) and ear canal using "state of the art" technology. This technology is based on the fundamental scientific principles of quantum mechanics, solid state physics, infrared optics, and microelectronics. Because infrared energy moves with the speed of light, one can measure the temperature of the tympanic membrane without direct contact [11].

The operation of Instant Thermometer is as following:
First, the device was switched on with the use of push button ‘start’. An ear tug was performed to straighten the ear canal which gives the device a clear view of the ear drum. While tugging the ear, the probe is snugly fit into the ear canal, and then the ‘start’ button was pressed. A short beep signaled the start of the measuring process. After one second a longer beep signaled the end of the measuring process. The temperature was shown on the display.

For the next measurement (after using cell phone in talk mode for 30 min), the used lens filter was replaced with new clean lens filter. The display was cleared by pressing the ‘start’ button once again. The device probe was inserted snugly in to the ear canal and then the ‘start’ button was pressed. The measuring procedure was repeated for selected subjects.

RESULTS AND DISCUSSION

Table1reveals data on tympanic (ear) temperature of 20 healthy volunteers of blood groups A, B, AB and O, before and after the use of mobile phone with SAR of 0.91 W/kg for 30 min. A maximum percentage change in temperature of 1.1 can be noted. Hence, it clearly shows that electromagnetic radiation of mobile phone does not have any thermal effect on the tympanic membrane.

It is a moot point to what degree of non-ionizing radiation may induce biological changes. It has been demonstrated that electromagnetic fields from 100 kHz and higher cause a thermal effect [12]. But the present investigation, especially for electromagnetic radiation to mobile phone, reveals completely different findings that there are not significant in the change of temperature of ear tissue, besides some of the researchers agree and other ones do not agree with Adair and Black [13 - 14]. So, finally the contradictions in the reports maybe because thermal effect of mobile phone radiation on the living tissues depends on time of the exposure; kind of the mobile phone used which has special SAR; type of the tissue that is exposed to mobile phone; and distance from mobile phone to tissue.

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Table1 - Data on human tympanic temperature before and after use of cell phone for 30 min.

Sample Code	Temperature ^{0}C		Change in temperature (%)
	Before	After	
A1	36.5	36.9	1.1
A2	37.1	36.9	-0.5
A3	36.8	37.0	0.5
A4	36.9	37.3	1.1
A5	36.7	36.9	0.5
B1	37.2	37.4	0.5
B2	36.9	37.3	1.1
B3	37.6	37.4	-0.5
B4	36.6	37.2	1.6
B5	3.72	37.4	0.5
AB1	36.9	37.1	0.5
AB2	36.4	36.6	0.5
AB3	36.5	36.6	0.3
AB4	36.4	36.5	0.2
AB5	37.1	37.2	0.3
O1	37.0	37.3	0.8
O2	36.2	36.3	0.3
O3	37.2	37.5	0.8
O4	36.9	37.0	0.3
O5	36.5	36.7	0.5

- ve sign means decrease; In sample code, First alphabet/alphabets refers 'blood group'; Numeral is serial number.

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