

Project Summary

The intensive use of mobile phones in the last 20 years has aroused concern about possible health problems caused by radio frequency electromagnetic waves (RF-EMW) emitted by these devices. Reports from epidemiological studies; including our recently published study, suggest that RF-EMW may negatively affect the men's fertility.

Pilot studies conducted by us have shown that exposure of ejaculated (neat) semen samples to commercially available cellular phones for one hour caused a significant decrease in sperm motility and viability, increased ROS levels and decreased ROS-TAC (reactive oxygen species-total antioxidant capacity) score when compared with neat semen from a non-exposed group.

Free radicals called reactive oxygen species (ROS) have been shown to be detrimental to sperm and are involved in the pathophysiology of male infertility. Antioxidants present in the semen can neutralize ROS. Oxidative stress occurs when there is an imbalance in the formation of ROS and the ability of antioxidants to neutralize ROS.

It's important to note that many men carry their cell phone in a trouser pocket (or clipped to their belts on waist) while using Bluetooth. This technology exposes testes to high power cell phone density compared with the cell phone in the stand by mode. The phone and the male reproductive organs are separated by multiple tissue layers. The deleterious effects of RF-EMW exposure from cell phone use on functional markers of spermatozoa from fertile and infertile men are not clear. Furthermore, the effects on spermatozoa of frequency, distance of the phone from source and the talk time are not known. The goals of this study are:

- 1). Design a two dimensional anatomical model of the tissue to extrapolate the effects seen in "in vitro" condition to real-life conditions. We will perform RF dosimetry (Radiation dosimetry is the calculation of the absorbed dose in matter and tissue resulting from the exposure to radiation) analysis using finite difference time domain (FDTD). We will design a model of the experimental set up that will calculate the distance between RF source and the semen sample. This set up will best represent specific absorbance rate (SAR) conditions *in vivo*.
- 2). Examine the effect specific cell phone RF, distance and talk time as determined from specific aim 1 on functional markers of oxidative stress in immature and mature spermatozoa. In addition to ROS, we will study DNA damage and apoptosis.
- 3). Study the impact of the RF-EMW emitted by the cell phone alone by eliminating effects of all other external sources by exposing semen samples to RF-EMW in a transverse electromagnetic (TEM) chamber.

Results from our study may help understand the mechanism of action of RF-EMW from cell phones on sperm quality in infertile men - a population who may already have sperm cells that are susceptible to oxidative stress and, therefore, be more susceptible to the negative cell phone effects.

Such knowledge may help modify/ revise guidelines for reducing the adverse effects of EMW in men who may be at increased risk of sperm damage and subsequent infertility.