

Cell Phone Radiation Degrades Semen Quality

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Evidence from our latest study has demonstrated a cause and effect relationship between cell phone usage and poor semen quality, recognized as a common cause for male factor infertility.

This study was the next step in our quest to define the relationship between cell phones and fertility that we first demonstrated in 2007. Our observational research demonstrating a strong negative correlation between cell phone usage and semen quality made national headlines. In general, semen quality tended to decline as daily cell phone use increased. Men who said they used their phones for more than four hours each day had the lowest average sperm count and motility and the lowest numbers of normal, viable sperm.

Our research over the past decade has demonstrated that oxidative stress impacts sperm health and semen quality. Reactive oxygen species (ROS) are produced continuously by spermatozoa, and they are neutralized by antioxidants present in the semen. A state of oxidative stress is created when ROS production exceeds the antioxidant capacity. We hypothesize that radiation emitted by cell phones in talk mode causes oxidative stress in the spermatozoa, which leads to the observed decline in semen quality.

We recently undertook a pilot study to test our hypothesis in a controlled, *in vitro* setting. In this study, semen samples from 23 healthy donors and nine patients presenting to the infertility clinic were divided into a control group (unexposed) and exposed group. Samples in the experimental group were exposed to radiofrequency electromagnetic waves (RF-EMW) emitted from a cell phone in talk mode for one hour. The control samples were kept under identical conditions but without RF-EMW exposure.

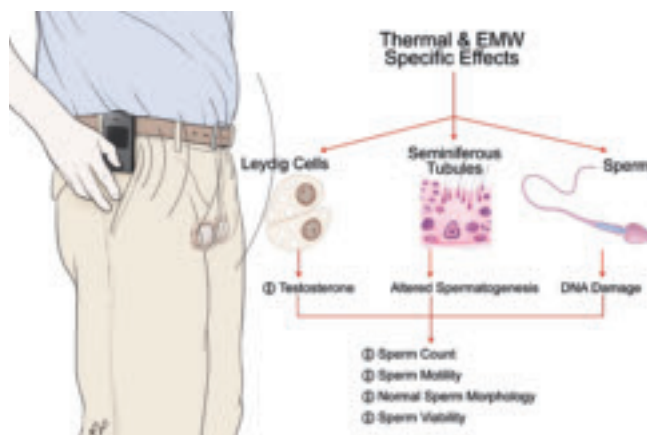
We then measured the level of oxidative stress by measuring the level of ROS and the total antioxidant capacity in a combined parameter known as the ROS-TAC score, which we have demonstrated to be a more accurate measure of oxidative stress than either ROS or TAC alone.

The most remarkable finding was an increase in ROS levels in RF-EMW-exposed semen samples. This increased ROS production possibly could be due to stimulation of the spermatozoa's plasma membrane redox system by RF-EMW or the effect of EMW on leukocytes present in the semen.

We also found a decrease in sperm motility, viability and ROS-TAC score in exposed samples. Short-term *in vitro* exposure to RF-EMW should not cause a decline in sperm concentration, and our data bore out this expectation. However, chronic oxidative stress may have deleterious

Key Point:

We began a quest to define the relationship between cell phones and fertility that we first demonstrated in 2007. From the data collected, we speculate that a cell phone in talk mode leads to deterioration of sperm quality through oxidative stress. Immature and abnormal spermatozoa may be more susceptible to these effects than are mature spermatozoa.



Possible effects of cell phone radiation on testes, spermatogenesis as well as on the ejaculated spermatozoa. This includes reduction in testosterone concentration, altered spermatogenesis and sperm DNA damage. EMW = Electromagnetic waves.

effects on sperm concentration. Smoking and varicocele are two common real-life examples of oxidative stress-provoking situations that we believe are worth considering in an evaluation for male factor infertility.

We found no change in sperm DNA integrity in the EMW-exposed group compared with the unexposed controls. This lack of DNA damage may be explained by the brevity of exposure to cell phone radiation or by the scavenging of free radicals by antioxidants in seminal plasma.

Nonetheless, the results of our study were significant and striking. The data lead us to speculate that carrying a cell phone in a pocket in talk mode leads to deterioration of sperm quality through oxidative stress. Immature and abnormal spermatozoa may be more susceptible to these effects than are mature spermatozoa.

One of the main differences between our experimental conditions and real-life is the multiple tissue layers that separate the cell phone and the reproductive organs *in vivo*. Further studies are needed to allow valid extrapolation of the effects seen under *in vitro* conditions to real-life conditions, and these are already under way in our laboratory. ■