



## Effect of Mobile Phone Exposure on Cognition of Medical Students

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### Abstract

**Background:** The increasing use of mobile phones in the present scenario and its adverse effects on human health is the topic of attention.

**Material and Method:** 50 healthy medical students of first Professional MBBS of Santosh medical college were randomly selected for the procedure. A computerized group of 15 words were presented to the participants and they were asked to reproduce it.

**Statistical Analysis:** Data was analysed by SPSS version 22.0 and  $p < 0.05$  was considered as significant.

**Result:** Our study result shows that use of mobile phones has significant negative effect on working memory.

**Discussion:** We conclude that use of mobile phone leads to impairment of working memory and cognition in medical students. It is therefore recommended that duration of use of mobile phones should be done in intervals rather than continuously.

**Keywords:** Mobile phones, Cognition, Short term memory, Working memory, Radio frequency Electromagnetic wave radiation (RF-EMW).

### Introduction

The increasing use of mobile phones in the present scenario and its adverse effects on human health is the current topic of attention<sup>(1)</sup>. Children and adolescents are of special interest due to their developing nervous systems<sup>(1)</sup>. It has been reported that mobile phone use for as short as five minute duration can have an effect on the cognition in humans<sup>(1)</sup>. Another study has shown that there is a significant effect of mobile phone use on cognition in young adolescents<sup>(2)</sup>. There are various studies

which show the effect of mobile phone use with media multitasking<sup>(3)</sup>, use of social networking sites<sup>(4)</sup> on spatial memory<sup>(5)</sup> and cognition<sup>(3,4)</sup>.

Cardis et al.<sup>(6)</sup> have shown how mobile phone electromagnetic waves (EMW) are localised in the various brain areas. ICNIRP<sup>(7)</sup> has given guidelines for limiting exposure to EMW radiation and WHO<sup>(8)</sup> has also given guidelines for exposure to mobile phone radiation. On the basis of these studies, it is apparent that mobile phones have a known effect on cognition. Our aim was to study whether a short exposure (5 minutes) to mobile phones could have

an effect on the working memory and cognition of healthy subjects.

**Material and Methods**

50 healthy medical students of first Professional MBBS of Santosh Medical College were randomly selected for the procedure. Informed consent was taken. It was a cross sectional study and ethical approval was taken from the institutional ethical committee.

A computerized group of 15 common words were presented to the participants on a 15 inch laptop screen from a reasonable viewing distance at eye level under appropriate illumination and they were asked to reproduce it on three pieces of paper marked a, b and c given beforehand for the three groups mentioned below. The words were presented very briefly (4 seconds each) in order to increase the difficulty of the task. Three measurements were taken: Group A: Before using mobile phone, Group B: Immediately after using mobile phone for 5 minutes, Group C: After 5 minutes of rest.

For each observation they were given the time of 1 minute to reproduce the words and at the end the sheets were collected and the correct written words were counted which was called as “Word Score” This was entered in to the records respectively using MS Excel.

**Statistical Analysis**

The data was analysed statistically by SPSS version 22.0 and p <0.05 was considered as highly significant. Comparison between the three groups was made by one- way ANOVA.

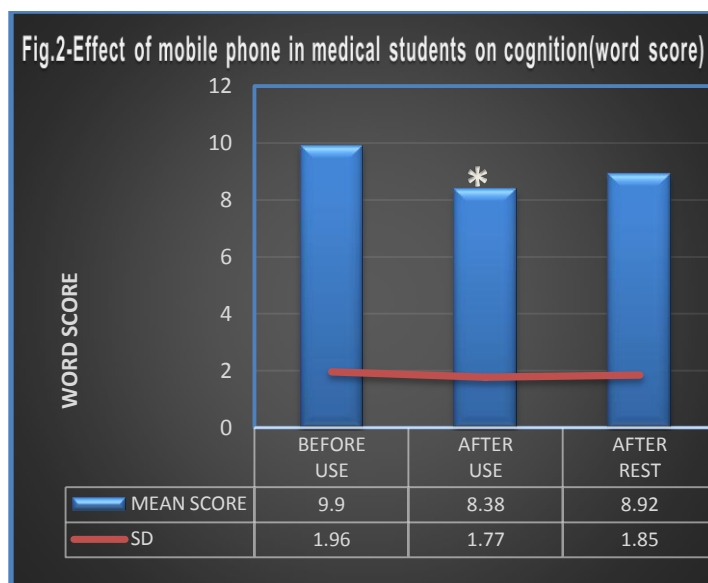
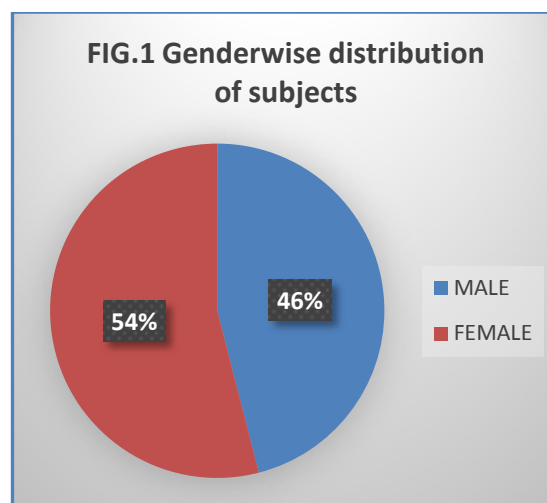
**Result**

The subjects were in the age range of 18 to 28 years. The mean age was 19.52 years and the standard deviation was 1.64 years for the study population as shown in Table 1.46% were males and 54% of the subjects were females as depicted in Figure 1.

Figure 2 shows the comparison of word score [the number of words remembered correctly after Group a: before using mobile phone Group b: immediately after using mobile phone for 5 minutes Group c: 5

minutes after the second measurement] in the three groups. There was a statistically significant difference between the after use group (B) with before use (A) and after rest group (C). This shows that there was a significant reduction in word count after use of mobile phone and an improvement of word count after rest.

Age range (years)	Age (years) (Mean±SD)	Gender	
		Males N (%)	Females N (%)
18-28	19.52±1.64	23(46)	27(54)



\*p value<0.05(highly significant)

**Discussion**

Our study result shows that use of mobile phones has significant (p<0.05) negative effect on working memory. The third reading (5 minutes after the 2<sup>nd</sup>

reading) was better than 2<sup>nd</sup> reading (after using mobile phone), but worse ( $p < 0.05$ ) than the 1st reading (before using mobile phone).

The effects of RF-EMW on DNA damage have been reported in various studies<sup>(11-17)</sup>. Lai and Singh reported an increase in ss and ds DNA breaks in the neurons of rat exposed for 2 hrs. to a 2450 MHz field. It was seen that EMW exposure cause DNA-protein and DNA-DNA cross links which increase apoptosis in neurons<sup>(11,12,15,16,17)</sup>.

Belyaev et al<sup>(14)</sup> have shown that exposure of rat neuron to microwaves results in changes in gene expression but does not lead to any breaks in the DNA structure. This may further lead to alteration in the healthy physiological functioning of the nervous system by expression of pro-apoptotic genes<sup>(14)</sup>.

Further, it was seen that antioxidants blocked this effect<sup>(18)</sup>. This shows that the mechanism of action of EMW on neuronal cells is free radical mediated. Similar results were found by Paul Raj and Behari<sup>(19)</sup> in rat neurons after 35 days of exposure. Nikolava et al<sup>(20)</sup> also reported increase in DNA double stranded breaks in embryonic stem cells.

These studies support the observation that the decrease in cognition observed in our study may be due to the effect of EMW on neurons. The mechanism of action may be free radical mediated as demonstrated by Lai and Singh in their previous study<sup>(18)</sup>.

### Conclusion

We conclude that use of mobile phone leads to impairment of working memory and cognition in medical students aged (18-28yrs). It is therefore recommended that duration of use of mobile phones should be done in short duration intervals rather than continuously for long periods of time.

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