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Experimental Design of the Effects of RF Shielded Hat on Electroenc Ephalo Gram (EEG) of Cameraman

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Abstract: In this study, the effects of exposure to Radio Frequency Electromagnetic Fields (RF-EMF) on cameraman will be investigated using Electro Encephalo Gram (EEG). There are two hypothesis will be tested which is firstly include the exposure of cameraman to the radio frequency that will affect their brain activity. Second, hypothesis involve the cameraman wearing a RF shielded hat can reduce the effect of exposure to RF-EMF. The 20 healthy cameramen will be involved in this experiment. Well-being and physiological measures of body temperature, blood pressure and heart rate will be obtained. The 2 types of exposure conditions will be conducted (Sham (no exposure) and wireless video-camera exposures). Each exposure will be lasted for 20 min session.

Key words: RF EMF, RF shielded hat, EMF exposure, wireless video camera, cameraman, Electroence Phalo Gram (EEG), temperature

INTRODUCTION

For the last decades, human has always exposed to Radio Frequency (RF) electromagnetic field because of rapid wireless communication devices usage. The potential negative consequences to our body make us worried about the effect of Radio Frequency (RF) electromagnetic field (Bernardi *et al*., 2000, 2009; Trunk *et al*., 2013). Furthermore, in the past, only the specific and well known of categories of workers have problems in Radio Frequency (RF) electromagnetic field exposure. However, now days an increased the number of workers that involved in Radio Frequency (RF) electromagnetic field exposure supported by the ever-rising development of wireless system (Bernardi *et al*., 2009).

Up to now, there are numerous ways to detect electromagnetic waves on the brain. The aim is to detect the presence of electromagnetic waves on the brain due to Radio Frequency (RF) electromagnetic field exposure. Amongst them there is one ways to detect the electromagnetic waves by using Electroence PhaloGraphy (EEG).

Electroence PhaloGraphy (EEG) is a test or method to record or measure electrical activity of the brain along the scalp. It will detect electrical activity of the brain. During the procedure, special sensors (electrodes) consisting of small metal discs are attached on the scalp.

Electrodes are simple design consisting of a metal contact surface and a flexible insulated wire ending with connecting pin which to mate the jackbox but now a days, researchers using wireless EEG for easier data collection. The electrodes detect tiny electrical charges that result from the activity of the brain cells. The charges are amplified and appear as a graph on a computer screen or as a recording that can be printed out on paper as wavy lines. As we know, EEG rhythms have different activities in specific frequency bands such as delta (0.5-3 Hz) theta (4-7 Hz), alpha (8-12 Hz), beta (13-30 Hz) and gamma (>30 Hz) (Trunk *et al*., 2013).

Cameraman is one of the jobs in which wireless technology has been used. Moreover, indoor and outdoor shots are an important requirement for quick and easier have pushed towards the introduction of wireless video-cameras. The use of wireless video cameras is also

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becoming more important due to the transition from analogue to digital broadcasting (Bernardi *et al*., 1996; Hisham *et al*., 2014).

The research about wireless video-camera exposure to the cameraman has not been done yet, therefore it has become a timely task. The study of occupational exposure of a cameraman conducted because of symptoms of dizziness, headaches and fatigue that happened to cameraman when using wireless video-camera during their research. This study, considering wear RF Shielded Hat with a standard wireless video-camera in typical operating conditions as an exposure (Hisham *et al*., 2014).

Subjects: The 20 subjects consist of cameraman will involve in this study. The selection criteria will be done by selecting the cameraman who had been directly involved with Radio Frequency (RF) electromagnetic fields exposure at workplace. The cameraman will be interviewed prior to the study. This is to identify whether they are really physically fit and free from neurological/psychiatric history problems. Healthy cameramen are eligible to take part in the experiments. The subjects will be explained about full experiment that will be conducted and they will give their written informed consent to participate in the study.

MATERIALS AND METHODS

The study will be conducted in a RF shielded room where the subject will be seated on a chair. The position of the wireless video camera was fixed on the right of the cameraman's shoulder where this position is much closer to our heads. The wireless video camera operated in standard frequency of typical operating conditions. Three different types of protective hat are chosen will be wore by cameraman: back of the hat with no protection to allow adjustment of size, rear hat that covers the neck and hat that covers head and thyroid region. Figure 1 shows types of hats that will be used.

The antenna embedded in the wireless module, is mounted on the wireless video camera and acted as a radiating source. The subjects will be positioned on a comfortable armchair in a relaxed position with their eyes closed and the chair is placed approximately 0.5 m away from the front of a computer screen. The subjects will be requested to avoid major movements and to stay awake. For EEG recording, the 14-channel Emotive EPOC EEG headset portable wireless device will be attached to the subject's scalp. EEG that is well known for record electrical activity within the brain will be recorded (Kwon and Hamalainen, 2011). For this study, EEG will record the brain activity whether subject feeling disturbed when wireless video-camera operated. Figure 2a-c shows

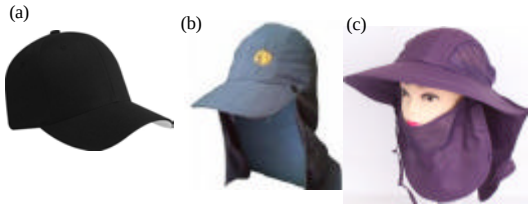

Fig. 1: Types of hats: a) the back of the hat with no protection to allow adjustment of size; b) rear hat that covers the neck and c) hat that covers head and thyroid region

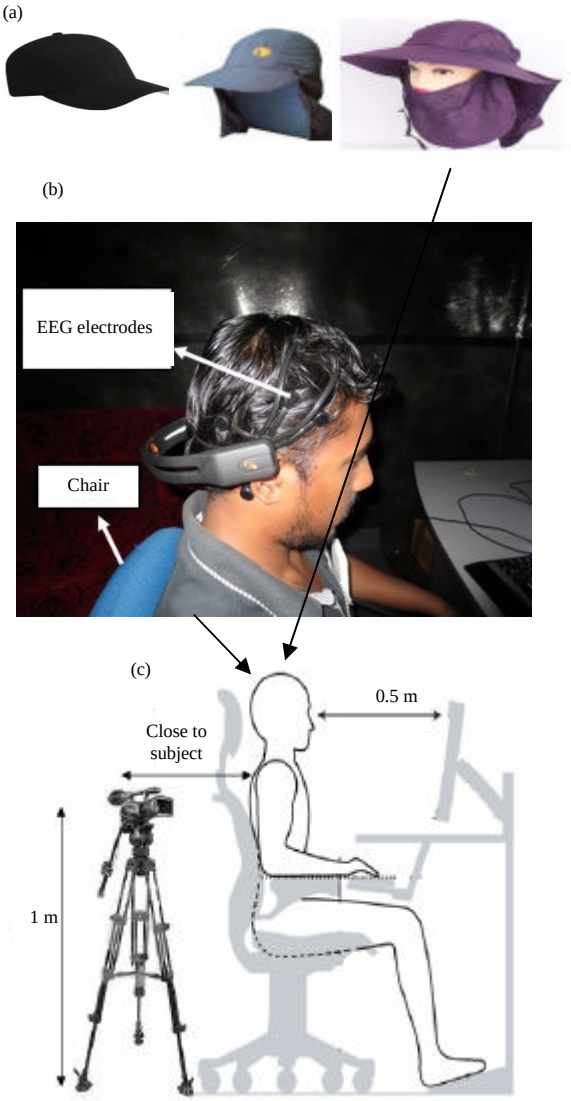

Fig. 2: Experimental design of the effects of RF shielded hats exposed to wireless video-camera for EEG: a) type of hats that will be used on the subject's head; b) EEG device positioned on the subject's head

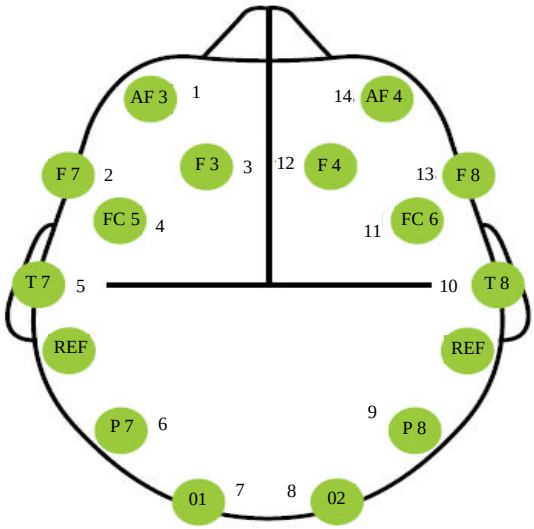

Fig. 3: Emotive EPOC electrode placement with 14 channels

the EEG device positioned on the subject's head and Fig. 3 shows the Emotive EPOC electrode placement with 14-channels, respectively.

RESULTS AND DISCUSSION

Exposure: This study will use two exposure conditions, with Radio Frequency (RF) electromagnetic fields and Sham (no exposure). The Radio Frequency (RF) electromagnetic fields will be generated by the antenna on the wireless video camera. The subjects attend a 1 h and 10 min recording session. In the first 30 min interval recording, 5 min comprises of exposure-free (pre-exposure) 20 min of exposure and 5 min exposure-free (post-exposure). The camera man receives a Radio Frequency (RF) exposure for 20 min (Rahim *et al*., 2015; Perentos *et al*., 2013).

CONCLUSION

Three different types of protective hats are chosen: back of the hat with no protection to allow adjustment of size, rear hat that covers the neck and hat that covers head and thyroid region. By using this shielded hats, it is hope that it will show a better performance to prevent the cameraman from RF-EMF exposure which can prove the hypothesis.

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