

## LEARNING FROM INCIDENTS IN RESEARCH STUDIES

### **The risk of burns in MRI scanning studies**

In a recent UCL study, a participant received a burn to the face from an electrode used in a MRI scanning study. It would appear that the leads from the electrode were connected to the wrong equipment.

Such incidents may be prevented through

- ensuring that incorrect connections can not be made and
- through designing a checklist for safe connection.

### **What happened?**

In this study, electrodes were attached to the participant's face and calibrated with the participant sitting in the MRI control room. The electrode leads were then unplugged from the stimulator equipment, the participant entered the scanner room and the leads were plugged into sockets inside the scanner room, connecting the electrodes (and thus, the participant) to a system of cables, RF filters, and an electrical ground connection situated in a patch-panel in the dividing wall between the scanner room, and control room. The other end of this system terminated in a trailing set of plugs, which are subsequently connected to the stimulator device placed in the control room, which is used to deliver stimuli to the subject during the course of the experiment.

When the leads were connected to the patch-panel sockets in the scanner room, the participant received a strong, painful electrical stimulus through one of the electrodes. This resulted in a burn to the face.

### **Why did this happen?**

A check of the study equipment found that the trailing set of plugs in the control room (i.e. the end of the cable/filter system) was not disconnected, but was in fact connected to another opto-electronic system, present in the control room, but not intended to be used in the experiment. An investigation found that the leads from the scanning suite into the control room had been incorrectly connected to an extraneous piece of equipment that converts a fibre-optic signal to a 5-volt electrical signal and a USB gamepad.

### **What steps can be taken to prevent this?**

1. Ensure that incorrect connections cannot be made:

- a. Install dedicated cables installed only to be used for delivery of electrical stimuli for a particular study.
- b. Change plug connections on other cables in the control room to different types, to ensure they cannot be connected to the electrical stimulus cables/equipment.
- c. Clear labelling of the dedicated cables to be used for delivery of electrical stimuli.

2. Creation of a pre-scan equipment checklist to cover all procedures involving connection of the participant to the equipment, in a check-box format, with all steps to be completed in strict order. The checklist is designed to ensure that the electrode cable (and therefore the participant) is always either:

- a. Connected to nothing,
- b. Connected directly to a piece of medically-isolated equipment (the Digitimer D185 stimulator; during the calibration session in the control room), or
- c. Connected to the medically isolated device through the dedicated system of cables and filters installed in the Faraday cage patch-panel (during the scan itself)

Correctly following the check-box procedures ensures that the participant can never be connected to anything other than the medically-isolated, certified equipment that the study requires.