

## PDS

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### **Problem Statement:**

Our client desires an efficient technique or device for repositioning a patient's head with respect to the TMS holder after moving from an EEG test to an MRI scan. This method must precisely relocate a patient's head within the limited space available and be transferable from one patient to another. Improvements for various factors for convenience are necessary and include, but are not limited to: reusability, ease of set up, precision and accuracy. The apparatus used will be transferred to numerous patients so an efficient sterilizing method must be implemented.

### **1. Physical Requirements:**

- a. *Performance:* The technique or instrument used to relocate the patient's head should precisely and accurately position the patient in a manner identical to previous tests with respect to the TMS holder. Operational conditions require this method to restrict patient movement the duration of tests in a comfortable yet efficient manner.
- b. *Safety:* Devices used in psychological tests shouldn't inflict pain or cause harm to the patient. The method used to restrain the patient in position must rest comfortably on the patient and have ease of quick removal in case of need to end the test abruptly due to a patient undergoing claustrophobic affects due to extended periods in the MRI scanner.
- c. *Accuracy and Reliability:* The ability to relocate patients in the exact location with respect to the TMS holder is of utmost importance because of the need to effectively stimulate specific regions of the brain, which may only have at most 1cm of error. In order to achieve precise data from these tests, the technique used to position the head must be able to accurately situate the patient in the different stages of testing.
- d. *Life in Service:* The relocating device will have a long time in operation. The tool used to relocate patients will be used for all patients undergoing psychological testing and is needed multiple times for each patient.
- e. *Operating Environment:* The apparatus used will be placed in multiple environments ranging from EEG testing sites to MRI scanners and must be able to withstand being transferred to and from different testing sites.
- f. *Ergonomics:* An essential feature is comfort of the patient while restrained by the device. Patients will be tested in the MRI scanner for extended periods of time which makes stress-free positioning a necessity. Also the relocating device will have to function while the patient is either in the prone or supine positions.
- g. *Size:* A small size is required due to the limited space within the MRI scanner. Within the scanner the "birdcage" surrounds the patient's head which has a total

- diameter of 28 cm which will need to be enough room for the patient's head, head rest, TMS device and the relocating device.
- h. *Weight*: Lighter weight is favorable in order to reduce strain on the mounting plate which is held in place by a nylon screw.
  - i. *Materials*: Supplies used in the device are limited to anything non-metal or non ferromagnetic metals in order to prevent interference with the MRI scan. Materials must also be durable for repeated use yet sterility is necessary due to use on several patients.
  - j. *Aesthetics, Appearance, and Finish*: Not of importance, difference in color in each piece of the device could facilitate ease of use.

## **2. Operational Requirements:**

- a. *Quantity*: Only one will be produced due to the specific nature of these psychological tests.
- b. *Target Product Cost*: The tests and scans are very expensive and highly funded but cost on this piece of equipment should be minimized.

## **3. Miscellaneous**

- a. *Standards and Specifications*: Convenience for those running tests, ease of use and quick setup should be emphasized.
- b. *Customer*: Dr. Brad Postle
- c. *Patient-related Concerns*: Minimize stress and maximize comfort