SURFACE ANTENNA ON SAMPLE POSITIONING DEVICE

The challenge

Nuclear Magnetic Resonance (NMR) is a widely used imaging technique in biological research today that combines the application of a strong magnetic field and a collection of coils and antennas to detect a radio-frequency signal from the sample. There are three types of antennas to be used depending on the area of interest to study, such as volume, internal or surface. Surface antennas are extendedly used as they provide a high signal-to-noise ratio; nevertheless, there are some draw backs to take into consideration about them. The existing positioning techniques used today are insufficient and imprecise, they consist of the use of adhesive tape for the attachment of the antenna to the sample. Moreover, the antenna must be connected to a preamplifier by a cable that might bend depending on the positioning of the antenna creating further problems in the image acquisition. Researchers from the Neurosciences Institute of Miguel Hernández University have developed a solution consisting of a positioning device that offers a precise mechanical placement technique for the antenna. The device is based on the positioning of the antenna by a swivel arm connected to a chassis, which allows for better quality results in pre-clinical studies of small animals.

Benefits

This novel device for surface radio-frequency antenna positioning brings many benefits when compared with the current techniques:
· The design of the device achieves a replicable, flexible and more precise arrangement of the antenna, allowing for a closer positioning to the zone of interest.
· With the mechanical arm in charge of the placement no unintended displacements can occur, which avoids the need to repeat the test after a first attempt.
· The layout of the device enables for the combination of brain studies with stimulation techniques. Furthermore, surgical procedures can be done at the time of the image acquisition.
· The device avoids the bending of the cable which eliminates any associated interferences.

Stage of Development

The benefits have been thoroughly tested in combined optogenetic/fMRI experiments in awaken rats and calibration experiments in MRI phantoms.
A Spanish Patent Application has been submitted at the Spanish Patent and Trademark Office (OEPM) in July 2021.

Objective of the collaboration

The represented institution is looking for a collaboration that leads to a commercial exploitation of the presented invention. The ideal scenario for the institution would be to reach an agreement in order to transfer the technology use by sale or a license (exclusive or non-exclusive). However, the form, terms, and conditions of the collaboration can be openly discussed if the presented technology is of interest.
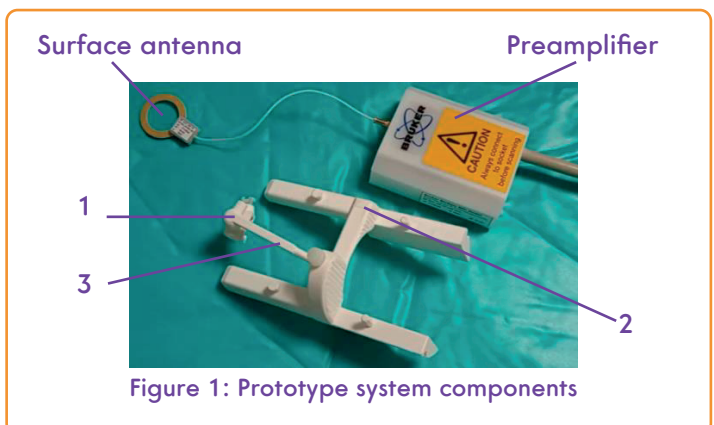
Technology description

The invention describes a device for surface radio-frequency antenna positioning over a sample for RMN imaging acquisition. A better placement technique is obtained using a swivel arm attached to the antenna which connects to the chassis of the device on the opposite side. The device has been designed for its use in pre-clinical studies in small animals particularly and to fit the bed or table in which the study would happen. As for the fabrication process, 3D printing with plastic is preferred but materials might vary between any technology with non-ferromagnetic materials.

Structuret

The system is essentially formed by the following elements:
· A coupler (1) destined to fasten the surface antenna by a pin section.
· A chassis (2) that fits the preamplifier connected to the antenna and lays in the bed of the RMN machine.
· A swivel arm (3) joined to the chassis that grants the sufficient degrees of freedom for an optimal positioning of the antenna.

Figure 1: Prototype system components

Figure 2: Prototype assembled in RMN equipment sample-bed

Represented Institutions and inventors

The principal inventors behind the technology are Luis Tuset Sanchis, from the functional Magnetic Resonance Imaging facility, and Víctor Javier Rodríguez Milán, from Scientific Hardware and Electronics service. Both are researchers at The Institute of Neurosciences, a public research center associated with the Miguel Hernández University of Elche (UMH) and the Spanish National Research Council (CSIC).

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