An integrated approach of interactive land-marking and auto coil detection

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Introduction Locating a landmark is the first step in the overall scan workflow however the current manual approach with a laser pointer has several shortcomings : 1) it is prone to errors even for the experienced technicians that may lead to improper coverage of the localizer scan; 2) land-marking for certain body regions such as the abdomen and chest may require body contacts with patients ; 3) the position of landmark also needs to be aligned with the receiver coil, which could be floating in nature that is subject to displacement prior to the scan. In this work, we propose a method that allows the user to choose the proper coverage of localizer scan on a graphical interface and may identify the actual location of the connected receiver coil with no extra time added to the overall scan. This method can also be operated in silent mode that produces ambient noise level acoustics.

Methods The key process in the proposed method is to acquire images on the go while the patient table is moving towards the magnet center, so that the reconstructed images may be coordinated and displayed for user to place a landmark. In addition, this continuous data acquisition may switch back and forward between the body coil and the surface coil so that the coverage of the surface coil may be derived. **Fig. 1(a)** illustrates the overall workflow. After loading the patient on the bed, the operator may directly proceed to move the bed to the magnet center. At the same time, the data acquisition using the pulse sequence in **Fig.1(b)** is triggered. The pulse sequence is modified from a spin echo acquisition, however with no phase encoding and modified z gradient axis. Turning off phase encoding leads to sampling of center of k-space line, and an inverse Fourier transform along the frequency encoding (L/R) leads to a projection along the A/P direction. Hence the acquisition during the table movement gives a coronal projection image. Note that the z gradient axis has been modified to eliminate the gradient switching for acoustic noise reduction (please refer to another abstract for details). The receiver coil switches between body coil and the surface coil (if connected), so that the images reconstructed from the body coil are used as a reference for landmark and those from the surface coil aid to locate the position of surface coil within the magnet.

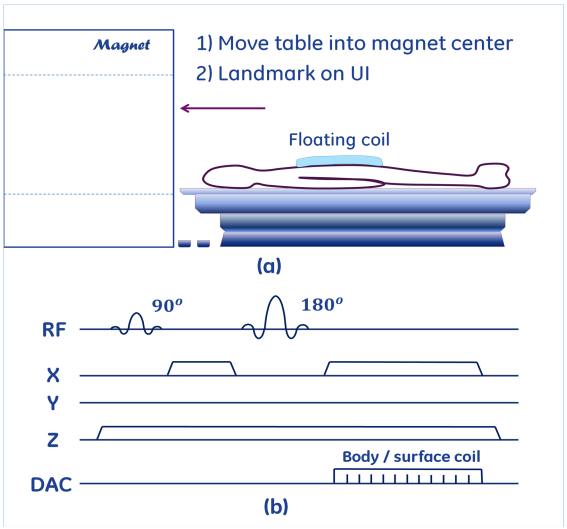

Figure 1 table move-in (a) is synchronized with continuous axial plane acquisition using (b)

Experiments and results The proposed method was implemented on a GE 1.5T scanner. A heathy volunteer with no prior knowledge of MR scan has been recruited for the experiment, consent form was obtained prior to the scan. A floating anterior coil array was placed on the subject's abdomen. After setting up the subject, the table was directly set to move to the magnet center without manual laser land-marking. Axial plane acquisitions were performed with pulse sequence in **Fig.1(b)**. In the duration of table move-in period of 13s, a total number of 64 slices were acquired, this gave a total coverage of 120 cm in the S/I direction. The reconstructed images from the body coil were cascaded to form a coronal projection image as shown in **Fig.2**(mid), and that from the floating coil is shown in Fig.2(left), which helped to identify its location as marked in Fig.2(mid). This information together were provided operator to select the desired region for localizer, as indicated by the red rectangle.

Discussion and conclusion The proposed method allows the position of the localizer scan to be comprehensively chosen with accurate knowledge of the coverage of the receiver coil. Given the overall scan was just over 10 seconds, and all the information were gathered and processed during the move-in of the table, no extra time was added to the scan process and when the operator returns to the operator console, the graphical information (illustrated in **Fig.2**) is already available on the screen for placing localizer. In this way, improper coverage of localizer scan, unnecessary body contacts with patients and blind knowledge of the location of the receiver coil are all avoided. This method was also silent in nature that ensures patient's comfort during the table movement.

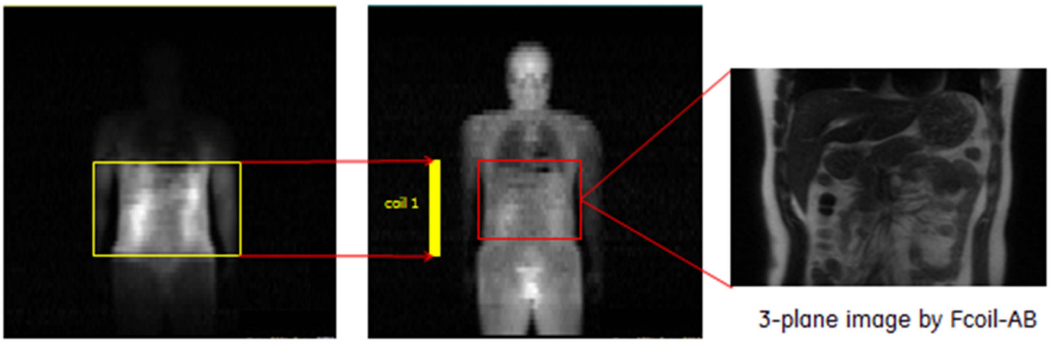

Figure 2 Multiplexed acquisitions using body coil and surface coil gives (middle) coronal plane projection that serves as graphical interface for placing a landmark (left) information for identifying the coverage of the surface coil. In this way, localizer coverage may be properly selected as indicated by red rectangle.