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# Table-Top Support Plate for Imaging the Entire Spine with Surface-Coil MR

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Use of a surface coil in MR imaging increases signal-to-noise ratio and improves image quality. The technique is used primarily for making a detailed examination of a specific anatomic region or a localized disease process. We describe a transport system that can be used with flat surface coils for examining extended regions of the body. The device is particularly useful for evaluating the vertebral column.

## Materials and Methods

The support plate\* is used primarily with flat surface coils, which are either round or rectangular. The individual components are depicted in Fig. 1. The plate has a rectangular shape and is made of Plexiglas. It is approximately 100 cm long, 1 cm thick, and fits the width of the concavity of the table top of the MR scanner. Two longitudinal pillars provide a channel for the surface coil travel. The surface coil is enclosed within a housing, which may be moved freely within the channel by means of a control rod. The coil travel path is divided into three segments corresponding to the cervical, thoracic, and lumbar regions of the spine. The points of advance, separated by a distance of 25 cm, are indicated on the control rod (Fig. 2).<sup>†</sup>

For the procedure, the support plate with surface coil positioned for cervical examination is placed on top of a standard MR table, with the inferior edge aligned with a stationary mark. The top may be covered with a thin foam pad or a bed sheet. The patient lies supine on the plate with the level of the external meatus aligned with the upper mark (Fig. 3). Longitudinal alignment of the body along the Z axis is adjusted with the help of a laser. The table travel system is zeroed to the midpoint of the surface coil. The cradle is advanced into the bore of the magnet for examination of the cervical region. After the cervical examination is completed, the standard table top is advanced 25 cm and then 50 cm cranially, and the coil is repositioned by pulling the control rod to the second and third steps for examination of the thoracic and lumbar regions, respectively. Should it be necessary to repeat any part of the examination, the coil may again be placed under the desired region without removing the patient from the gantry. Examination time for the entire spine will vary with the number of planes and sequences. Using short echo sequences, it is usually possible to complete the average study within 1 hr.

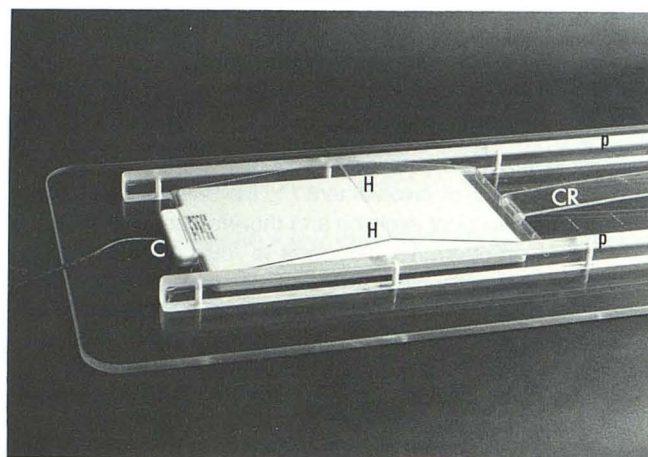


Fig. 1.—Support plate, view from below. The pillars (p) create the channel (C) for surface coil travel. Rectangular, planar surface coil measuring 11 × 5 in. rests within housing (H) in travel channel (view from below). CR = control rod.

## Results

Initially, four healthy volunteers were examined with this technique (Fig. 4). T1-weighted images of the cervical, thoracic, and lumbar spine were obtained in sagittal plane, using spin-echo sequences with TR/TE of 600/20 msec. Slice thickness was 5 mm, matrix size was 256 × 256, and there were four excitations. The scanning time for one region was slightly over 10 min. The total examination time varied between 45 and 60 min. Good quality images were obtained, and all volunteers tolerated the examination well. Subsequently, 21 patients with vertebral metastases were examined. Eighteen examinations were completed successfully. One examination could not be performed because of claustrophobia; another two examinations had to be interrupted because of pain, evidently resulting from inadequate analgesia.

\* Patent pending. The device is currently being developed by Medical Advances, Inc.

<sup>†</sup> The plate is custom designed to fit individual coil and MR unit.

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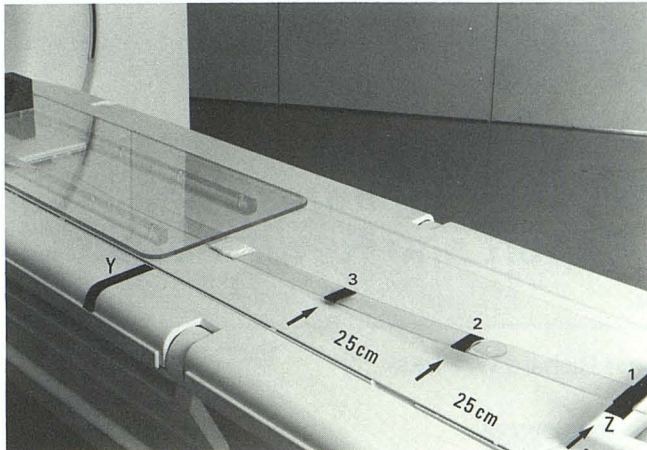


Fig. 2.—Support plate positioned for examination of cervical spine. Lower edge of plate is aligned with lateral table mark (Y), and first position of control rod (1) is aligned with stationary mark along foot of table top (Z). For examination of thoracic and lumbar regions, rod is withdrawn to second and third positions (2, 3). Points of advance are separated by a distance of 25 cm (arrows).

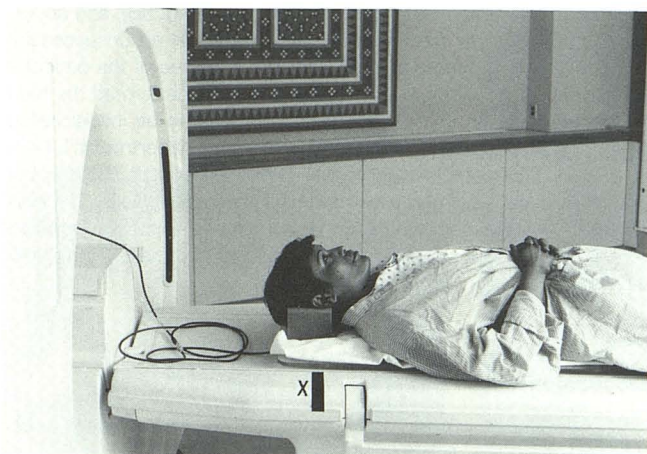


Fig. 3.—Patient ready for examination. The mark (X) indicates that upper edge of surface coil is aligned with external auditory meatus.

## Discussion

In MR imaging, surface coils enhance the detection of the signal, improving resolution of small anatomic structures [1]. Although greater anatomic detail is achieved than with the standard body coil, the area examined is limited by the size and configuration of the coil. In assessing the spine, surface coils are used primarily for evaluating the extent of a local disease process. MR examination of the entire spine may be necessary in screening for diffuse involvement, particularly metastatic disease. Under the usual circumstances, a surface coil can be used but this requires manual repositioning, resulting in patient discomfort and prolongation of the study. The support plate eliminates the need for repositioning of the coil outside the gantry, and it considerably facilitates the procedure, particularly if the patient is unable to move. Since the length of the average human spine is 65–70 cm [2], three placements of the coil are adequate for total coverage. In



Fig. 4.—Composite MR image of entire spine of a healthy volunteer. Fall-off margins have been excluded. Coverage of entire spine is provided without gaps.

short individuals two placements may suffice. There is no loss of image quality.

In general, the routine examination of a limited area of the spine usually includes T1 and T2 information. Detection of abnormalities of the bone marrow, particularly vertebral metastases, relies mainly on T1-weighted images [3]. To limit the examination time, we use T1-weighted sequences to examine patients with spinal metastases. In our experience the plate was well tolerated by the majority of patients.

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