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AUDITORY IMPLANTS FOR ADULTS

# In-vivo re-magnetization of a cochlear implant magnet using 3T magnetic resonance imaging

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## Abstract

Many cochlear implants (CI) users have concomitant medical conditions which required additional medical support, including the use of diagnostic imaging such as magnetic resonance imaging (MRI). An additional risk of static magnetic field exposure, especially with field strengths exceeding 1.5T, is de-magnetization or polarity reversal of the CI magnet.

Newer generation devices have a diametric magnet which can freely rotate when subjected to the static MRI field. This free rotation mitigates the risk of magnet dislocation, demagnetization, and polarity reversal.

In this report, we describe the in-vivo re-magnetization of the implant magnet of an older generation CI after it had been demagnetized via inadvertent exposure to a 3.0T MRI field. To our knowledge, this is the first report of re-magnetizing an implanted CI magnet in a clinical setting.

## Objective

To study a procedure for in-vivo partial re-magnetization of a demagnetized cochlear implanted patient via the magnetic field generated by an MRI.

## Case Report

The subject of this case report was a 26-year-old male patient who had been unilaterally implanted ten years prior. The implanted device was a SONATA TI100 CI with a standard (31.5 mm) electrode array (MED-EL, Innsbruck, Austria).

The patient underwent two consecutive MRI scans with no headband applied. The second scan was ordered at a field strength of 3.0T (General Electric 3T Discovery MR 750). The 3.0T scan was not completed because the patient indicated pain and pressure around the implant area. It was noticed that after the aborted 3.0T MRI scan the retention of the AP-coil was poor, possibly due to a weakened CI magnet.

It was proposed to attempt an in-vivo re-magnetization of the implant magnet using an MRI scanner with a sufficiently strong static magnetic field.

**Important re-magnetization considerations:**

- **The CI magnet must be oriented parallel to the direction of the static field of the MRI.**
- **It was necessary to first determine the field orientation of the scanner.**
- **The ideal positioning of the patient was outside of the scanner tube. The head orientation depend of the field orientation of the scanner (Figure 1).**

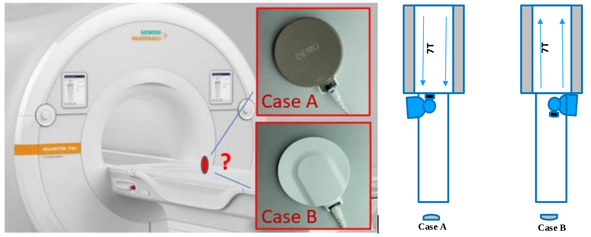


***Figure 1:*** *The two possible orientations of the axial AP-coil when exposed to the static magnetic field of the MRI scanner. Positions close to the opening of a 7.0T MRI scanner for re-magnetizing a CI magnet, depending on the orientation of the static magnetic field of the scanner*

## Results

A protocol for partial re-magnetization was developed:

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| **Step 1** | Remove AP-coil and apply head bandage over the implant. |
| **Step 2** | Identify the magnetic field polarity of the MRI by means of the patient's AP-coil. |
| **Step 3** | Position patient on the patient table with the head inclined to the side determined under Step 2. |
| **Step 4** | Let the patient bend forward toward the center of the scanner entrance and maintain this position for 5-seconds. |
| **Step 5** | Check if the implant magnet is strong enough to retain the AP-coil. |
| **Step 6** | Repeat Steps 3 to 5 until the test in Step 5 is fulfilled. |

The procedure was repeated (twice in this case) until the implant magnet strength was regained. The impedance values of the electrodes and the ground path impedance were similar pre- and post-treatment.

A follow-up examination was performed on the patient four weeks post-treatment; the patient was found to be comfortable and using their speech processor daily.

## Conclusion

This is the first study to successfully demonstrate the partial re-magnetization of a CI magnet using a 3.0T MRI scanner in-vivo. This procedure is a potential option to resolve de-magnetization issues without surgery or device replacement.

## Bibliography