MRI for Nucleus® implant recipients

Radiographer’s instructions

Nucleus® implants offer patients a high level of MRI safety. Some straightforward precautions must be followed by the radiographer. Please read this leaflet carefully. For more information, contact Cochlear. If you are in Australia, please call 1800 620 929, if you are in New Zealand, please call 0800 444 819. If required, the patient’s cochlear implant surgeon or audiologist can also provide information.

Please note: Instructions should be followed for each side if the patient has two cochlear implants.

GENERAL CONSIDERATIONS
MRI for a Nucleus recipient is straightforward. It is not necessary to:
• Contact Cochlear Ltd or the implanting surgeon
• Wait for months after implant surgery
• Position the patient in a certain way
• Perform a CT scan to check bone thickness under the magnet

HOW SOON AFTER IMPLANTATION SURGERY?
Before performing an MRI, it is prudent to wait until the swelling from implantation surgery has reduced. For most patients, this is two to four weeks.

IMAGE ARTIFACT (SHADOWING)
In some situations, the implant’s magnet must be removed before MRI (see page 2).

With the magnet in place, shadowing may extend as far as 11 cm or 4.3 in. from the implant

With magnet removed, shadowing may extend as far as 6 cm or 2.5 in. from the implant
Before the MRI

STEP 1. DETERMINE WHICH NUCLEUS IMPLANT THE PATIENT HAS

MRI indications differ depending on the type (model) of implant. You must know which model the patient has before proceeding with the MRI. To determine the model, check the patient’s ID card, or contact their physician.

If uncertain of the model, check the three radiopaque letters on the implant by taking a plain film X-ray of the skull. To position the patient for the X-ray, consider that the patient’s external transmitting coil is directly above the implant (it is magnetically attached to the patient’s skin by the magnet in the implant). Position the patient so that the X-ray film is parallel to the implant site (usually a near-lateral view). The middle radiopaque character indicates the model (as below).

<table>
<thead>
<tr>
<th>Implant</th>
<th>Model</th>
<th>Middle Radiopaque Character</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nucleus® 5</td>
<td>CI512</td>
<td>N/A (indentify by shape)</td>
</tr>
<tr>
<td>Hybrid™ L24</td>
<td>CI24REH</td>
<td>6</td>
</tr>
<tr>
<td>Nucleus® Freedom™ with Contour Advance™ Electrode</td>
<td>CI24RE (CA)</td>
<td>S</td>
</tr>
<tr>
<td>Nucleus® Freedom™ with Straight Electrode</td>
<td>CI24RE (ST)</td>
<td>4</td>
</tr>
<tr>
<td>Nucleus® 24 Contour Advance™</td>
<td>CI24R (CA)</td>
<td>2</td>
</tr>
<tr>
<td>Nucleus® 24 Contour™</td>
<td>CI24R (CS)</td>
<td>C</td>
</tr>
<tr>
<td>Nucleus® 24k</td>
<td>CI24R (ST)</td>
<td>H</td>
</tr>
<tr>
<td>Nucleus® 24</td>
<td>CI24M</td>
<td>T</td>
</tr>
<tr>
<td>Nucleus® 24 Double Array</td>
<td>CI11+11+2M</td>
<td>P</td>
</tr>
<tr>
<td>Nucleus® 24 ABI</td>
<td>ABI24M</td>
<td>G</td>
</tr>
<tr>
<td>Nucleus® 22 with removable magnet</td>
<td>CI22M</td>
<td>L or J</td>
</tr>
<tr>
<td>Nucleus® 22 without removable magnet</td>
<td>CI22M</td>
<td>Z</td>
</tr>
</tbody>
</table>

STEP 2. CHECK THE INDICATIONS BELOW

Nucleus® CI500 series, Nucleus® Freedom™ and Nucleus® 24 series

<table>
<thead>
<tr>
<th>Field Strength</th>
<th>Instructions</th>
<th>Go To MRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 1.5 Tesla (T), up to and including 3.0 T</td>
<td>Surgically remove the magnet for MRI. Tissue damage may occur if the magnet is in place during MRI.</td>
<td>MRI with magnet removed, page 3</td>
</tr>
<tr>
<td>More than 0.2 T, up to and including 1.5 T</td>
<td>Leave the magnet in place for MRI and bandage around the head.</td>
<td>MRI with magnet in place, page 3</td>
</tr>
<tr>
<td>0.2 T or less</td>
<td>Leave the magnet in place for MRI. No bandaging required.</td>
<td>MRI with magnet in place, page 3</td>
</tr>
<tr>
<td>Other field strengths</td>
<td>MRI is contraindicated</td>
<td></td>
</tr>
</tbody>
</table>

Nucleus® 22 with removable magnet

<table>
<thead>
<tr>
<th>Field Strength</th>
<th>Instructions</th>
<th>Go To MRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to and including 1.5 T</td>
<td>Surgically remove the magnet for MRI. Tissue damage may occur if the magnet is in place during MRI.</td>
<td>MRI with magnet removed, page 3</td>
</tr>
<tr>
<td>Other field strengths</td>
<td>MRI is contraindicated</td>
<td></td>
</tr>
</tbody>
</table>

Nucleus® 22 without removable magnet: MRI is contraindicated
MRI with magnet in place

1. See Before the MRI, page 2. The magnet can only be left in place for some implants at certain field strengths.

2. Tell the patient that they may feel a slight pulling sensation during the MRI. See Patient Comfort below.

3. Remove the patient’s external equipment (speech processor and coil) before they enter the MRI room. Note: The patient cannot hear without the external equipment.

4. If the scan is at 0.2T or less, bandaging is not required. Go to step 5.
   If the scan is at more than 0.2T, up to and including 1.5T, bandage around the head as follows:
   • Use an elasticised compression bandage with a maximum width of 10 cm or 4 in. Generic bandages are suitable. No special bandage is required.
   • Ensure the centreline of the bandage is over the implant site.
   • Use a minimum of two layers at or near full stretch to apply firm pressure to the implant site. “Full stretch” - no elasticity remaining in bandage
   • If the patient develops pain due to the bandage, check that it is not too tight, and if necessary, consider an MRI scan at 0.2T (no bandaging required). Alternatively, consult the patient’s physician to determine whether the magnet should be removed or whether a local anaesthetic may be applied to reduce discomfort. See also Patient Comfort below.

5. Conduct the MRI scan. There is no need to position the patient in a particular way because of the implant.

PATIENT COMFORT

Please explain to the patient:
The compression bandage (for MRI above 0.2T) will prevent the implant magnet from moving, however the patient may still sense pressure on the skin as the magnet resists movement. The sensation will be similar to pressing down firmly on the skin with the thumb, and will not damage the implant or hurt the patient.

If the patient is not comfortable, or the sensation is considered excessive, remove the patient from the MRI scanner and consider an MRI at 0.2 T (where no bandaging is required). Alternatively, consult the patient’s physician to determine whether the magnet should be removed or whether a local anaesthetic may be applied to reduce discomfort.

MRI with magnet removed

See Before the MRI, page 2. The magnet must be removed for some implants at certain field strengths. Instructions for surgeons are on page 4.

If a patient’s implant magnet has been temporarily removed, they may present for the MRI with a sterile dressing over the implant site. Patients who require multiple MRI exams over a period of time may have had their implant’s magnet replaced with a non-magnetic plug. In both cases:
• Ensure that the implant model is known and that the MRI will comply with indications (page 2).
• Conduct the MRI as for any patient. It is not necessary to apply additional bandages or follow special procedures.
Magnet removal - surgeon's instructions

See Indications, page 2, before considering magnet removal.

REMOVING THE MAGNET BEFORE IMPLANTATION

If a new recipient has a condition that requires future MRI examinations over 1.5 T soon after implantation, the magnet may be replaced with a non-magnetic titanium plug before the device is implanted. Refer to the Surgeon’s Guide for instructions.

REMOVING THE MAGNET AFTER IMPLANTATION

Remove the magnet in sterile conditions, using general or local anaesthetic:

1. Make a small incision, ensuring there is good access to the magnet. The incision must be to the side of the implant (not over the coil). See Figure 1.
2. Cut through any fibrous growth around the implant and expose the magnet.
3. Use an elevator (or similar instrument) to lift the lip of the silicone recess around the magnet and remove the magnet. If a retaining suture runs across the magnet, move the suture out of the way. See Figure 2.

The procedure then differs according to whether the patient requires a single MRI or multiple MRI examinations.

SINGLE MRI

1. Make a small incision and remove the magnet.
2. Leave the magnet recess empty and apply a dry sterile dressing, without closing the wound. The recess may remain empty with sterility maintained, for up to four hours.
3. Take the patient for the MRI exam.
4. After MRI, insert a sterile replacement magnet with the star symbol (polarity) facing up. Some implants, like the CI512 don’t have a star. Use an elevator to lift the lip of the recess and position the magnet.
5. Close the wound in layers.

MULTIPLE MRI

If the patient requires multiple MRI exams over a period of time, replace the magnet with a sterile, non-magnetic titanium plug. The plug prevents fibrous tissue growing into the recess.

1. Make a small incision and remove the magnet (see above).
2. Lift the lip of the recess using an elevator and press the non-magnetic plug into position. Do not exert undue pressure on the implant.
3. Close the wound in layers.

When MRI is no longer a regular necessity:

1. Make a small incision, exposing the magnet recess.
2. Remove the plug, using the above procedure.
3. Insert a sterile replacement magnet with the star (polarity) facing up. Some implants, like the CI512 don’t have a star. Use an elevator to lift the lip of the recess and position the magnet.
4. Close the wound in layers.

ORDERING PLUGS AND MAGNETS

For CI500 Series Implants:

- Z146624: CI500 Series non-magnetic plug
- Z179608: CI500 Series sterile replacement magnet

For Freedom, N22 and N24 implants:

- Z50100 Sterile, non-magnetic plug
- Z50101 Sterile magnet

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