

Siting the receiver-stimulator of the CI-24M model of the Cochlear Limited multiple-channel cochlear implant, and fixation of its electrode array

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SUMMARY

The correct siting of the cochlear implant receiver-stimulator package is important. The package should not obtrude significantly above the surface of bone, and should be placed so that blows to the head do not result in damage to the package, skull or brain.

The cochlear implant electrode array must be fixed at a site close to the cochlea, so that the electrode will not slide out, or be subject to differential movement with growth changes. Fixation, with Dacron® mesh, platinum-iridium ties, or clips, has been in the region of the posterior root of the zygoma and the floor of the antrum. Our research studies demonstrate that a specially-designed collar around the array can be placed through the cochleostomy and provide the necessary locking to prevent retraction of the array. It has a ceramic surround to encourage union with neighbouring bone, and stress relief to reduce wire fracture at the point where the array leaves the cochlea.

SITING THE COCHLEAR CI-24M RECEIVER-STIMULATOR

The receiver-stimulator package of the CI-24M implant is 4.7 mm thick, 18 mm wide and 25 mm long¹. The small size makes it possible to site the implant with the outer surface flush with the bone of the skull.

The dimensions of the package were designed with young children in mind. The receiver-stimulator can be sited in the mastoid cavity below the floor of the middle fossa without depressing the sigmoid sinus or dura.

When the patient uses the BTE speech processor, the receiver-stimulator should be sited so there is enough room in the front of the antenna for a finger to operate the control on the back of the processor's housing. The incision should be traced using a template with the antenna 45 mm from the ear canal (Fig. 1).

For children, it is recommended that the implant be placed superficially and drilling be limited to 2 mm, the depth of the rounded bulge on the electronic package.

INCISION AND PREPARATION OF THE PACKAGE BED

The direction and length of the skin incision will depend on the shape of the head and the orientation of the device under the skin. The incision should extend above the root of the pinna, postero-superiorly up to 8 cm, and the antenna can be sited in a plane between the scalp and periosteum. This plane should be the width of the antenna (33 mm). The antenna is connected to the titanium housing of the electronic package at an angle of 160° to conform with the curve of the skull. The receiver-stimulator should lie in a more vertical orientation in children because of the small radius of the occipital region.

FIXATION OF THE ELECTRODE ARRAY AND SEALING THE COCHLEOSTOMY

It is desirable to secure the electrode array of a cochlear implant device against traction on the lead². The cochleostomy is prepared by removing bone just anterior and inferior to the round window (Fig. 2). When the cochleostomy is correctly located the opening should provide the surgeon with a good view along the scala tympani. If the facial nerve obscures the round window, the site of the opening will vary.

A small area of the bone of the promontory is removed, bearing in mind how the scala tympani will arch from the round window, and the need to define endosteum before entering the scala tympani (Fig. 2). When an introducer is used for a peri-modiolar electrode array, the opening

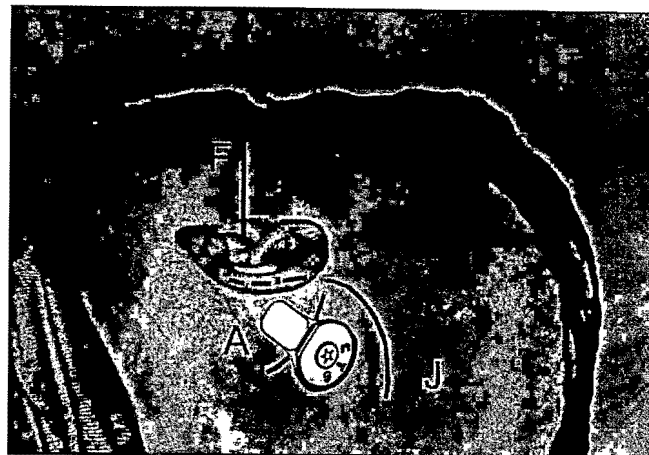


Fig. 1 Diagram of the template for the CI-24M cochlear implant, used to outline the surgical incision³. (J - incision, F - Frankfurt's line, A - postero-superior arc). The antenna should be behind the arc A 45 mm from the ear canal, and the front edge of the device 20 mm from the canal. Above the root of the pinna the incision extends postero-superiorly up to 8 cm. The limb should allow for a vertical orientation of the device in children.

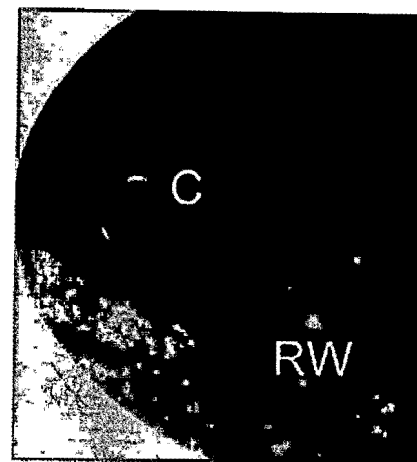


Fig. 2 The cochleostomy (C) for a standard electrode insertion. The site is selected antero-inferior to the round window (RW), and bone is drilled like a saucer until the endosteal membrane is reached.

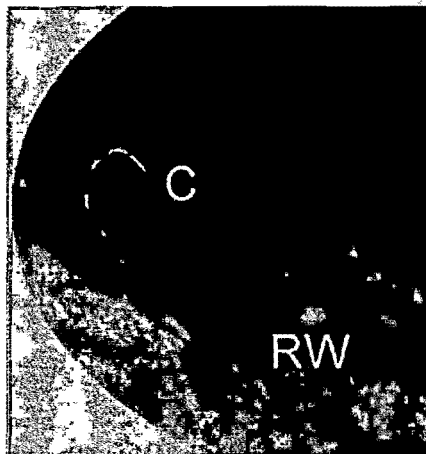


Fig. 3 The cochleostomy (C) for a peri-modiolar electrode insertion. The standard cochleostomy is enlarged anteriorly when the curvature of the scala tympani and spiral lamina will be better seen. The opening is enlarged so the introducer for the peri-modiolar array can be passed to a depth of 6 mm.

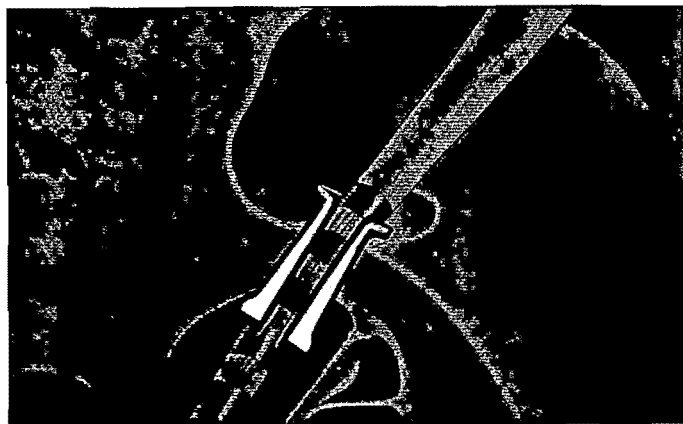


Fig. 4 The Silastic collar used for fixing the electrode array in the cochleostomy and sealing the opening.

should be enlarged anteriorly so the introducer will pass to a depth of 6 mm (Fig. 3).

After the standard array has been inserted, a Silastic collar with seal may be slid along the lead into the cochleostomy (Fig.4). It can have a split in it so that it can be applied to the array after insertion. The collar, which is elliptical in shape, locks the electrode array into the opening. It can be used for both standard and peri-modiolar arrays. The Silastic collar insures a considerable grip. In laboratory tests the lead will stretch before it will be released from the window when traction is applied. The collar has ceramic surrounding it so that long term bonding can take place with the cochlear bone. The seal between the electrode and the collar is achieved with a glue such as Silastic A. Stress relief is obtained by having the collar taper external to the cochlea.

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