THE BIOSAFETY OF HYALURONATE (HEALON) FOR COCHLEAR IMPLANTATION

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Insertion of the electrode array of multiple channel cochlear implants may be aided using Hyaluronate. It is felt that this substance acts as a lubricant allowing the array to be inserted more deeply and less traumatically. This has potential advantages of improving pitch perception in cochlear implant patients. To investigate the biosafety of Hyaluronate an animal study was undertaken. Dummy electrodes were inserted into the cochleae of six normal hearing cats. Hyaluronate was used as a lubricant in one ear and the other ear served as a control. Measurement of hearing thresholds before and after surgery did not reveal hearing loss attributable to the lubricant. The temporal bones from these cats were sectioned and the histological sections analysed for evidence of spiral ganglion cell or hair cell loss. Initial results have not demonstrated poorer spiral ganglion cell survival or greater hair cell loss. The temporal bones from these cats were sectioned and the histological sections analysed for evidence of spiral ganglion cell or hair cell loss. Initial results have not demonstrated poorer spiral ganglion cell survival or greater hair cell loss. The temporal bones from these cats were sectioned and the histological sections analysed for evidence of spiral ganglion cell or hair cell loss. Initial results have not demonstrated poorer spiral ganglion cell survival or greater hair cell loss.

The Nucleus 22 Channel Cochlear Implant device has been employed at the Mayo Clinic since 1988. Several techniques have been reported for fixation of the electrode array. The electrode array has been fixed in position with fibrin glue in the last 65 patients. Autologous fibrin glue was used in one patient and homologous fibrin glue was used in 64 patients. In addition to fixing the electrode array, the fibrin glue is also beneficial in sealing the cochleostomy site and beneficial in the prevention of a perilymphatic fistula. No adverse affects due to the fibrin glue have been observed in this series of patients.


COMPARISON AND ALTERNATE DESIGNS FOR PERI-MODIOLAR ELECTRODE ARRAYS: INSERTION TRAUMA AND POSITION

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While it has been shown that the straight but flexible banded electrode array can be safely inserted into the scala tympani of the human cochlea, histological studies have revealed that the array lies along the outer wall. Since a profound total hearing loss is generally associated with a moderate to complete degeneration of the spiral ganglion peripheral process, these electrodes lie some distance from their target neural population - the spiral ganglion soma - located within Rosenthal's canal. Electrophysiological results have shown that moving the electrode array from the outer wall to a site close to the modiolus results in a significant reduction in threshold and an increase in dynamic range. These findings imply that peri-modiolar electrodes will produce more focalized neural excitation patterns, resulting in an increase in the number of discriminable electrodes, and leading to further improvements in speech perception. In the present human temporal bone study we have been evaluating electrode insertion trauma and electrode position within the scala tympani for up to five peri-modiolar electrode designs. Three arrays of each design have been evaluated. Each array was inserted into the scala tympani of a fixed human temporal bone which had been prepared as it would for cochlear implant surgery. The electrodes, which were inserted by the one surgeon with considerable clinical experience, were fixed close to the cochleostomy. The temporal bones were X-rayed to accurately determine insertion depth and the location of...
individual electrodes. Finally, the cochleas were embedded in plastic, 300 µm thick sections were cut with the electrode array in situ, and each section photographed to scale. Using image analysis techniques, the projection of the electrode array within the cochlea was determined. Evidence of insertion trauma - in particular to the basilar membrane or osseous spiral lamina - was documented for the complete cochlear spiral. Finally, the position of the electrode array relative to the modiolus was measured for each electrode design. The results will be discussed in light of the potential clinical significance of each design.


THE NUCLEUS 1+10+11 COCHLEAR IMPLANT (DOUBLE ARRAY): A NEW OPTION FOR OSSIFIED COCHLEA.
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Introduction:
Cochlear Implantation in ossified cochleas is possible. The limited number of stimulating electrodes together with the histological changes, however, limit the possible performance in those patients.

Concept:
By dividing the standard 22 channel electrode array into two separate electrode arrays it is possible to place one array into the basal turn and a second array into the second turn. This will increase the number of stimulating electrodes and the modalities of intracochlear stimulation (bipolar, monopolar, between the arrays).

Surgical concept:
The posterior tympanotomy is enlarged superiorly and the incus is removed. Standard cochleostomy is performed and the new built tissue formation is removed from the basal turn until the anterior border of the cochlear is reached. A second cochleostomy below the cochleariform process is performed with entering the second turn. In most cases the second turn is still open. The double array can be inserted with one array in the drilled-out basal turn and the second array in the second turn. All other steps are done in a standardized way.

Patients:
Until now 12 patients with ossified cochleas have been implanted.

In all patients the double array could be inserted. The intraoperative Stapedius reflex showed higher than normal values but could be elicited. No complication occurred. Identification of the facial nerve was no problem.

Result:
The patients experience a gap in the pitch scale, however, the enlarged frequency range down to the low frequencies allows them to receive important speech cues. The performance data after three and six months show open speech understanding in 8 out of 12 patients with monosyllable word understanding between 5 and 50 per cent. Compared to patients with operated cochleas using the standard device the results are significantly better.

Conclusion:
The double ray offers a new treatment modality for ossified cochleas. Due to the increased number of electrodes more information can be transmitted. The probability of facial nerve stimulation is diminished and the performance is increased.

Bacterial Meningitis is the most common cause for partial or complete ossification of the cochlea. It can take place as early as 4 months after meningitis. The clinical issues are: 1. Imaging, 2. Surgery, 3. Programming.

A high resolution CT scan of the cochlea should be carried out as soon as possible and a MRI scan may be necessary. Surgery should ideally be carried out before the onset of ossification. However, if ossification has already taken place, there are various surgical options. 1. Scala vestibuli approach; 2. Drill out of the basal turn of cochlea; 3. Circum-modal or trough; 4. Single channel large base electrode. In our experience, while these procedures are excellent surgical exercises, the ultimate benefit to the patient is disappointing. An alternative surgical approach through an apical cochleostomy should be considered in those patients where imaging indicates patent apical and middle turns of the cochlea. This approach will bring the electrode array in contact with a larger number of surviving neurons, with the prospect of better benefit.

Key words: 1. Ossified cochlea, 2. Apical cochleostomy, 3. Surviving neurons

EPIDEMIOLOGICAL STUDIES ON MENIERE'S DISEASE
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Since 1975, the Research Committee of Meniere's Disease (MD) and Peripheral Vestibular Disorders in Japan has several times made nation-wide and regional survey studies on the according to the drafted criteria. The epidemiological characteristics obtained from these surveys were summarized as follows.
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