Insertion of the electrode array of multiple channel cochlear implants may be aided using Hyalurone. 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 cochlea 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 Hyaluronate. 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 in the group in which Hyaluronate was used.

THE BIOSAFETY OF HYALURONATE (HEALON) FOR COCHLEAR IMPLANTATION

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EXPERIMENTAL AND CLINICAL STUDIES OF INTRACOCHLEAR ELECTRODE BEHAVIOUR

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Among other features intracochlear electrodes should be as atraumatic as possible, located close to the structures to be stimulated, and easy to insert.

We report about results of a temporal bone and plastic model study of the dynamics of intracochlear electrode movement of various electrode types (manufactured by Cochlear Corp. and Advanced Bionics).

Clinical experience (1993) with tip bending in Clarion patients prompted us to investigate the insertion process more closely. We drilled the usual posterior access to expose the promontory and exposed the cochlea from appically. After drilling a spiral shaped bone flap, we exposed and regionally removed to have an open view onto the basilar membrane during insertion. After electrode positioning, the basilar membrane was removed and the exact electrode position investigated.

Some results were:
1. Kinking or tip bending of original Clarion spiral electrodes can be prevented by proper insertion technique in practically all non obstructed cochleae. The major aspects of successful insertion of these electrodes proved to be appropriate insertion angle and placement depth of the insertion tool.
2. Incorporation of short (2mm) straight section at the tip of the spiral electrode has eliminated the occurrence of kinking or bending in subsequent trials with both the human temporal bones and clear plastic model.
3. Possible basilar membrane injuries can be avoided by a clear view to the modiolus which requires a sufficiently large cochleostomy to either see directly into the cochlea or to insert an endoscope.
4. The model was very useful for practising the cochleostomies in case of insertion of two electrode arrays like in double array implants.
5. The combination of artificial and "real" models provides a quite potential concept to get clinically relevant information important for electrode development for cochlear implants.

Findings and clinical relevance will be discussed with special regards to reimplantation and special surgical situations as met in the last 500 implantations performed at Hannover Medical School (N > 1000).

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 localised 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