RESEARCH SUMMARY

INSERTION CHARACTERISTICS AND PLACEMENT OF THE MID-SCALA ELECTRODE ARRAY IN HUMAN TEMPORAL BONES USING DETAILED CONE BEAM COMPUTED TOMOGRAPHY

Dietz A, Gazibegovic D, Tervaniemi J, Vartiainen VM, Löppönen H; European Archives of Oto-Rhino-Laryngology 2016; Epub ahead of print , DOI 10.1007/s00405-016-4099-x

Advanced Bionics introduced the HiFocus™ Mid-Scala electrode (HFMS) in February 2013. Developed through extensive research, the HFMS is designed for mid-scalar placement to protect delicate cochlear structures, and to offer surgical flexibility and ease of use.

KEY TAKE AWAY POINTS

- Many cochlear implant (CI) candidates have residual hearing that may be aidable if acoustic hearing can be preserved during surgery. The HiFocus Mid Scala electrode (HFMS) was designed to minimize insertion trauma and to preserve cochlear structures.
- This temporal bone study used a precise imaging technique to assess the position of the HFMS implanted in the cochlea.
- The results support the atraumatic design (no translocation observed in this study) of the HFMS and its consistent mid-modiolar placement.

OBJECTIVES

This study evaluated the HFMS in fresh human temporal bones using cone beam computed tomography (CBCT) followed by 3D reconstruction. The analysis focused on the scalar location and position of the electrode relative to the inner and outer cochlear walls.

METHODS

- The HFMS was inserted very slowly, with a free hand technique, through the round window (RW) membrane in 8 fresh human temporal bones until the second blue marker was even with the RW.
- Pre- and post-insertion CBCT scans were registered to create a 3D reconstruction of the cochlea with the electrode in place.
- An image fusion technique (developed by the University of Maastricht) was used to identify the exact position of the array.
- Scalar location was measured at 4 points along the cochlear base at angular insertion depths of 90°, 180° and 270° and at the most basal electrode contact.

RESULTS

- Smooth insertion through the RW membrane was possible in all temporal bones.
- Imaging showed no translocation from the scala tympani (ST) into the scala vestibuli.
- Angular insertion depth varied from 335 to 400° (median 384°).
- There was a significant negative correlation between cochlear size (length) and angular insertion depth.
- The HFMS was positioned in the middle of the ST along the entire length of the array in 3 of 8 bones and in 62% of the individual locations measured along the cochlear base.
- In 4 temporal bones, individual electrode segments appeared to approach or touch the lateral wall but otherwise remained in a mid-modiolar position.
- For all 8 temporal bones, the electrode did not appear to touch the modiolar wall and the array remained within the ST along its entire length.

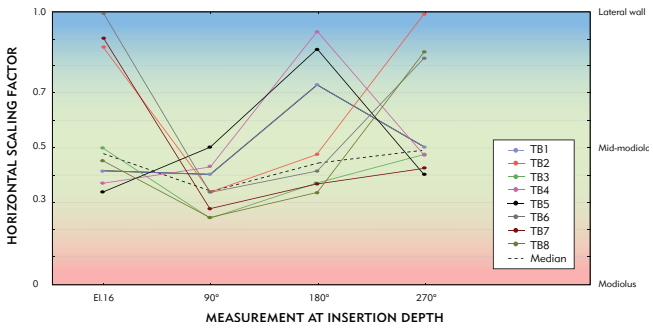

Figure 1. *Horizontal positioning of the HFMS electrode in 8 temporal bones. The median horizontal position was mid-modiolar.*

- In one cochlea, close proximity of the electrode to the basilar membrane indicated possible contact.

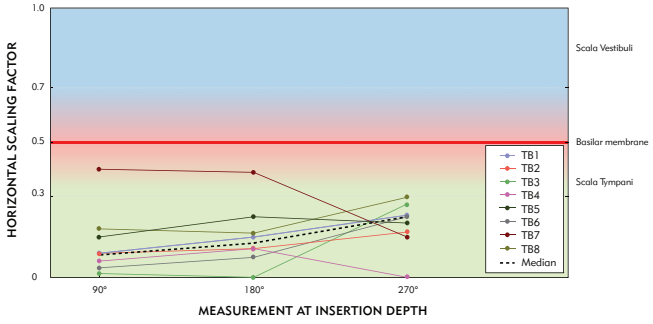

Figure 2. *Vertical positioning of the HFMS electrode in 8 temporal bones. All electrode contacts were within the ST.*

CONCLUSIONS

- CBCT and 3D modelling accurately showed that the HFMS electrode array can be inserted consistently within the ST at a mid-modiolar position, thereby demonstrating its atraumatic insertion characteristics. This imaging technique currently represents the most accurate CBCT method for electrode position assessment.

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