SUMMARIES OF JOURNAL ARTICLES

- Aschendorff A, Kromeier J, Klenzner T, and Laszig R. Quality Control After Insertion of the Nucleus Contour and Contour Advance Electrode in Adults. Ear & Hearing, 28:75S-79S, 2007.
- Skinner MW, PhD; Holden TA; Whiting BR, PhD; Voie Ah, PhD; Brunsden B; Neely JG, MD; Saxon EA, MEng, MME; Hullar TE, MD; and Finley CC, PhD. In Vivo Estimates of the Position of Advanced Bionics Electrode Arrays in the Human Cochlea. Ann Otol Rhinol Laryngol 2007;116(4) Suppl 197:1-24.
- Fraysse B, Macias AR, Sterkers O, Burdo S, Ramsden R, Deguine O, Klenzner T, Lenarz T, Rodriguez MM, Von Wallenberg E & James C. Residual Hearing Conservation and Electroacoustic Stimulation with the Nucleus 24 Contour Advance Cochlear Implant. Otology & Neurotology, 27:624-633, 2006.
- Roland, JT Jr. A Model for Cochlear Implant Electrode Insertion and Force Evaluation: Results with a New Electrode Design and Insertion Technique. Laryngoscope, 115: August 2005.
- Adunka OF, Buchman CA. Scala Tympani Cochleostomy I: Results of a Survey. Laryngoscope, 117: December 2007.
- Briggs RJS, Tykocinski M, Stidham, K, Roberson JB. Cochleostomy site: Implications for electrode placement and hearing preservation. Acta Oto-Laryngologica, 2005;125: 870-876.

SUMMARY OF JOURNAL ARTICLE

Aschendorff A, Kromeier J, Klenzner T, and Laszig R.

Quality Control After Insertion of the Nucleus Contour and Contour Advance Electrode in Adults

Ear & Hearing, 28:75S-79S, 2007.

> Objective of the study

To evaluate the quality of insertion including electrode position of Contour™ and Contour Advance™ electrodes in adult recipients.

> Study design

Evaluation of electrode position in adult recipients using research based rotational tomography technique. Electrode position was identified as being in the Scala Tympani (ST), Scala Vestibuli (SV) or partly in both scala. The study population included 21 recipients with Contour electrode and 22 recipients with Contour Advance electrode.

Speech test results were measured and a correlation performed with position of the electrode.

> Key findings in the paper include

One large clinic with highly experienced implanting surgeons measured a very high proportion of unintended Scala Vestibuli (SV) insertions due to cochleostomy location and scalar dislocations from Scala Tympani (ST) to SV due to electrode mechanics in patients using the Contour electrode. By observing these results the clinic adjusted technique and dramatically improved the proportion of insertions into the ST. The use of the Contour Advance electrode with Soft Surgery technique including Advance Off-Stylet™ (AOS) technique further increased the ability to achieve ST insertions.

- After finding a high rate of SV insertions with the Contour electrode, the cochleostomy position was changed to a more inferior position to ensure electrodes were inserted into the ST.
- Contour Advance electrode (with soft-tip) inserted with AOS technique increased ST placement further and reduced the chance of scalar displacements.
- ST insertion gave statistically significant improved speech performance over SV insertion.

SUMMARY OF JOURNAL ARTICLE

Skinner MW, PhD; Holden TA; Whiting BR, PhD; Voie AH, PhD; Brunsden B; Neely JG, MD; Saxon EA, MEng, MME; Hullar TE, MD; Finley CC, PhD.

In Vivo Estimates of the Position of Advanced Bionics Electrode Arrays in the Human Cochlea

Ann Otol, Rhinol & Laryngol 2007;116(4) Suppl 197:1-24.

> Objective of the study

To describe a new technique to determine position of electrode arrays with application to Advanced Bionics electrodes. To use this technique to measure correlation between electrode position and speech perception performance.

> Study design

Clinical images were taken of the cochlea of adult recipients with CT scanners before and after implant surgery. Specialized research imaging software was used to register the scans against each other to allow identification of the position of the electrode arrays in the cochlea.

Comparisons with high resolution scans of an unimplanted body donor enabled accurate identification of the electrode placement in the recipient cochleae to determine whether each electrode contact was in the Scala Tympani (ST) or Scala Vestibuli (SV).

Electrodes in the patient population included 14 HiFocus® 1/1J electrodes (4 with positioner) and 1 Helix® electrode.

> Key findings in the paper include

This article is both about a method used to visualize electrode position using a combination of pre and post-operative scans and special imaging software as well as the results of using the method on Advanced Bionics (AB) electrode arrays.

- The method allows accurate measurement of electrode position.
- Despite experienced surgeons, 100% (15/15) of AB's electrodes (14 HiFocus 1 / 1J electrodes (4 with positioner), and 1 Helix electrode were found with all or part of the electrode in the SV.
- 6/15 electrodes in the study were inserted directly into the SV.
- 9/15 were inserted directly into the ST however all 9 were shown to induce trauma in a substantial proportion of patients by pushing into the lateral wall and migrating from the Scala Tympani (ST) to the Scala Vestibuli (SV).
- Speech perception performance was significantly negatively correlated with the number of electrodes in the SV.
- Speech perception performance was not related to insertion depth.

SUMMARY OF JOURNAL ARTICLE

Fraysse B, Macias AR, Sterkers O, Burdo S, Ramsden R, Deguine O, Klenzner T, Lenarz T, Rodriguez MM, Von Wallenberg E and James C.

Residual Hearing Conservation and Electroacoustic Stimulation with the Nucleus 24 Contour Advance Cochlear Implant

Otology & Neurotology, 27:624-633, 2006.

> Objective of the study

To study the conservation of residual hearing in recipients of the Nucleus® 24 Contour Advance™ cochlear implant and the benefits of combined electrical and acoustic stimulation.

> Study design

Adult recipients with residual hearing were implanted using soft surgery technique. The soft surgery technique included a 1-1.2mm anterior-inferior cochleostomy with a 17mm insertion using the Advance Off-Stylet™ (AOS) technique. Hearing thresholds were measured before and after surgery. Patients with sufficient hearing post-operatively were fitted with an ITE hearing aid for electro-acoustic stimulation.

> Key findings in the paper include

This article is about the preservation of residual hearing in a large number of adults implanted with a full-length Contour Advance electrode with AOS technique, and benefit derived from the use of residual ipsilateral residual hearing amplified with an ITE hearing aid.

- Of a group of 27 subjects implanted with a full-length array, 10 (the "EI-Ac" group) retained enough hearing for an ipsilateral hearing aid to be of sufficient benefit (no greater than 80 dBHL at 125 and 250 Hz, and no greater than 90 dBHL at 500 Hz).
- Of a subset of 12 of the 27 subjects where there were no surgical deviations from a "soft surgical" approach 9 (75%) retained hearing sufficient to fit a hearing aid.
- Long term data was available for 9 patients. Hearing was stable for 5 of these 9 after 13 months.
- Of the subjects who had sufficient hearing to use electro-acoustic hearing, mean performance on words in quiet and sentences in noise statistically improved.
- Subjects in the EI-Ac group had similar CI only (ie. Not using acoustic hearing) performance to subjects who had lost residual hearing ("CI-only users").
- 78% of the electro-acoustic subjects preferred a program where the CI provided only higher frequencies compared to typical CI frequencies.

SUMMARY OF JOURNAL ARTICLE

Roland JT, Jr.

A Model for Cochlear Implant Electrode Insertion and Force Evaluation: Results with a New Electrode Design and Insertion Technique

Laryngoscope, 115:1325–1339, 2005.

> Objective of the study

To evaluate the insertion characteristics of the Contour Advance™ electrode in temporal bones.

> Study design

A variety of techniques were used in the study:

- Contour Advance electrodes were inserted using Advance Off-Stylet™ (AOS) technique into 5 cadaveric temporal bones while being viewed using fluoroscopy (video x-rays).
- Histologic evaluation was then conducted on the 5 bones by a process involving embedding in acrylic, sectioning and inspection for trauma and electrode position.
- Hydraulic pressure within the cochlea during insertion of the Contour Advance was measured in another bone.
- Mechanical insertion forces were measured for Contour™ with Standard Insertion Technique (SIT) and Contour Advance with AOS technique. The forces were then compared.

> Key findings in the paper include

- Fluoroscopy and histology show that Contour Advance with AOS technique achieves its design goals of consistent perimodiolar positioning in the Scala Tympani and an atraumatic insertion with limited outer wall forces through a smooth insertion without contact with the outer wall of the cochlea.
- Hydraulic pressure analysis shows that the electrode size and shape allows egress of perilymph around the array, resulting in no detectable hydraulic forces in the cochlea.
- Insertions of Contour Advance electrode with AOS technique are less traumatic and result in a more reliable placement than the Contour electrode inserted with Standard Insertion Technique thus the Contour Advance with AOS technique is a significant improvement over the Contour electrode with Standard Insertion Technique.

SUMMARY OF JOURNAL ARTICLE

Oliver F. Adunka, MD; Craig A, Buchman MD.

Scala Tympani Cochleostomy I: Results of a Survey

Laryngoscope, 117:2187–2194, 2007.

> Objective of the study

To assess current surgical techniques for scala tympani cochlear implantation among North American surgeons.

> Study design

A survey was distributed to cochlear implant surgeons at the 2006 William House Cochlear Implant Study Group in Toronto, Canada. Only surgeons were asked to fill out the survey:

- The survey was anonymous
- Questions were asked about the number of devices implanted per year, drill type and burr size, questions about how each surgeon usually drills the facial recess and the cochleostomy, and
- Three intraoperative images depicting various views through the facial recess onto the promontory were presented and surgeons asked to identify the location they would drill the cochleostomy on each image.

> Key findings in the paper include

- More than 60% of the respondents performed more than 20 implants per year so it was an experienced group.
- Surgical experience correlated to cochleostomy location and final size of the cochleostomy. Less experienced surgeons tended to place the cochleostomy superior to the round window (away from scala tympani) and with a larger cochleostomy.
- The survey demonstrated marked variations in surgical techniques for scala tympani cochlear implantation.
- Authors seek "aggressive dissemination of such information… …to make surgeons aware of these important techniques."
- This quote says it all:
  "Overall, uniformity in scala tympani cochleostomy placement is lacking. This probably has resulted from the general feeling that precise location within the cochlea is unnecessary. Recent studies now suggest that electrode location should be within the scala tympani, and that dislocations or placement of the array into the scala vestibuli may result in worse outcomes [references to Skinner et al 2007 and Aschendorff et al 2007]."

SUMMARY OF JOURNAL ARTICLE

Briggs RJS, Tykocinski M, Stidham K, Roberson JB.

Cochleostomy site: Implications for electrode placement and hearing preservation

Acta Oto-Laryngologica, 125:870-876, 2005.

> Objective of the study

The objective is to review the results of previous temporal bone electrode insertion safety studies, and of post-mortem temporal bone histology of cochlear implant (CI) recipients. The aim is also to review previous anatomic studies of the cochleostomy region.

> Study design

- In Melbourne, 14 temporal bones were studied with three different electrode designs. "An initial precurved electrode array" was inserted with a cochleostomy placed anteroinferior and separate to the round window niche. Contour™ and Contour Advance™ electrode arrays were inserted with a cochleostomy placed directly inferior to and in contact with the round window membrane.
- In Palo Alto, 27 human temporal bones were dissected and measured to demonstrate the anatomic details of the relevant area.

> Key findings in the paper include

- A cochleostomy that is anterior to the round window niche "may open both scala tympani and scala vestibuli and will expose the attachment of the basilar membrane."
- Electrode insertion into a cochleostomy that is anterior to the round window niche will "always result in local damage to the attachment of the basilar membrane and may result in the insertion of the array into the scala media or scala vestibuli."
- "Siting the cochleostomy immediately anterior or anteroinferior to the round window niche places both the basilar membrane and spiral ligament at risk, and the array may well be inserted into the scala vestibuli."
- The paper includes a detailed description of the anatomy of the scalae near the round window.
- "The anatomy indicates that a cochleostomy positioned anterior to the round window not only places the basilar membrane and spiral ligament at risk during insertion, but also increases the possibility of insertion of the electrode array into the scala vestibuli."
- The authors "recommend that the cochleostomy is directly inferior to the round window membrane and hence initial visualization of the round window is necessary." This will often require removal of the bony overhang of the round window niche (called the subiculum).
- The importance of visualizing the round window niche is emphasized. In cases where there is limited access, the authors recommend to drill a generous posterior tympanotomy including skeletonizing the facial nerve to allow complete visualization of the round window niche.

Cochlear™

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