

Hearing Preservation Rates of Straight Electrode Arrays from a Large Cochlear Implant Center

INTRODUCTION

Over the years, softer and less traumatic surgical techniques, in combination with thinner and more flexible electrode array designs, have shown that preservation of intracochlear structures and residual hearing is possible following cochlear implant (CI) electrode array insertion¹⁻⁵.

Hearing preservation can lead to better post-operative speech recognition in quiet⁶, speech recognition in noise^{7,8}, localization abilities⁹, music perception abilities¹⁰, and offers the possibility to stimulate electro-acoustically¹¹.

This white paper is a compendium of three published papers¹²⁻¹⁴ from one large CI tertiary center in Germany, Medizinische Hochschule Hannover (MHH). These publications report on hearing preservation rates of the most used straight electrode arrays from the three largest CI manufacturers.

METHODS

All three publications classified their subjects into two groups based on differences between pre- and post-operative unaided audiometric hearing thresholds: hearing preserved (30 dB or less) and no hearing preserved (greater than 30 dB). Hearing preservation was evaluated by four post-operative follow-ups across the first twelve months: one, three, six, and twelve months.

The table below shows the number of subjects who received a particular array across all three studies, as well as the median pre-operative air conduction (AC) unaided audiometric hearing thresholds for all devices evaluated:

Electrode array	Group size	Pre-op AC
Advanced Bionics SlimJ (23 mm)	38	61.0 dB
Cochlear Slim Straight (20-25 mm)	28	59.0 dB
MED-EL Flex24 (24 mm)	24	70.0 dB
MED-EL Flex28 (28 mm)	17	76.0 dB

Table 1: Group sizes (left column), and pre-operative AC unaided audiometric hearing thresholds (right column), by electrode array

As shown in Table 1, pre-operative median AC hearing thresholds (measured as the average of median thresholds between 125 and 1500 Hz) were similar across the three studies, highlighting the validity of comparisons across the publications reviewed in this white paper.

RESULTS

Short-term hearing preservation rates are more favourable for the Advanced Bionics HiFocus SlimJ array compared to both similar length arrays as well as a longer array from the competition. When comparing similar length electrode arrays one month after surgery, the SlimJ indicates an 87% chance of hearing preservation within 30 dB, 12% higher than the Slim Straight and 5% higher than the Flex24.

Additionally, compared to a longer electrode array such as the Flex28, SlimJ shows a 22% higher incidence of short-term hearing preservation.

See figure 1 below for a breakdown of short-term (one month after surgery) hearing preservation rates by electrode array:

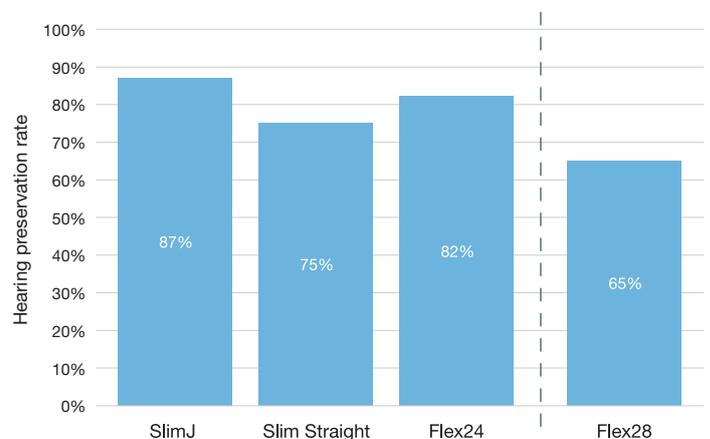


Figure 1: Short-term hearing preservation rates by electrode array measured one month post-operatively.

■ ≤ 30 dB

The long-term hearing preservation rate for the SlimJ also outperform the competitions' products. 79% of SlimJ cases show hearing preservation rates within 30 dB, with comparable length arrays such as the Slim Straight and Flex24, showing 5% and 12% lower long-term hearing preservation, respectively. Longer electrode arrays, such as the Flex28, shows the lowest long-term hearing preservation rates from the electrodes evaluated in these papers, with only 42% of hearing preserved after twelve months, 37% lower than the SlimJ.

See figure 2 below for a breakdown of long-term (twelve months after surgery) hearing preservation rates by electrode array:

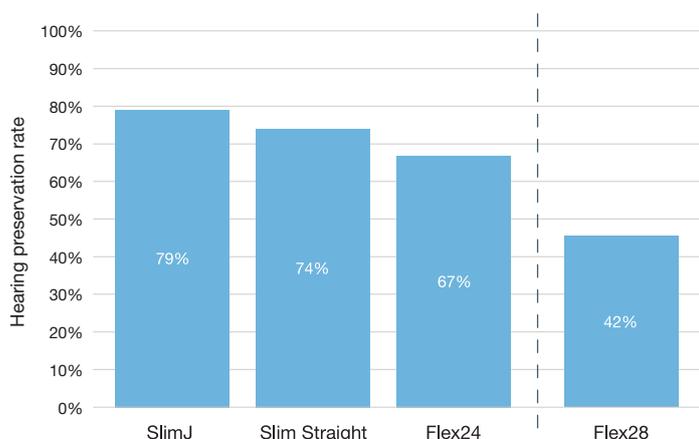


Figure 2: Long-term hearing preservation rates by electrode array measured twelve months post-operatively

■ ≤ 30 dB

SUMMARY

The HiFocus™ SlimJ electrode array shows remarkable and unparalleled, both short- and long-term, hearing preservation results within the most used straight electrode arrays in the CI market.

With a length of 23 mm and an angular insertion depth of 420°, the HiFocus SlimJ is designed for optimal speech recognition through spiral ganglion coverage while minimizing the risk of trauma or perceptual distortions reported with deeper insertions¹⁵⁻¹⁹.

CONSIDERATIONS

- The graphical data presented in the three publications differ in their visual representation. To aid visual analysis, new graphs summarising the results in the same style were produced presenting short- and long-term post-operative time-points.
- Lenarz et al. (2020) only presented short-term hearing preservation data up until 1 month post-operatively. Long-term hearing preservation data by MHH were presented at the CI2021 and ESPCI 2021 conferences and are in the process of being published by MHH. The long-term data presented here is based on preliminary data from MHH, with their permission, for long-term comparison across devices.
- Jurawitz et al. (2014) compared two sets of electrode arrays in their evaluation. Similarly, Suhling et al. (2016) compared three sets of electrode arrays in their evaluation. For this white paper, only the most widely used straight arrays have been summarised to make a relevant clinical comparison. Therefore, the Hybrid L-24 and Flex20 electrode arrays were not included as they are significantly shorter (16mm and 20mm lengths respectively) than the rest of the electrode arrays presented here.
- Jurawitz et al. (2014) only measured pre-operative thresholds from 250 to 1500 Hz. An interpolation of the 125 Hz threshold was calculated based on the slope of the pre-operative thresholds to recalculate the median value shown in table 1.
- All three publications present data in two groups: complete datasets across the twelve months period (same N number across all stages) and incomplete datasets across intermediate testing stages (different N number across all stages). This white paper evaluated only complete datasets across the twelve months period for reliability and to avoid skewed data collection owing to participants lost to follow-up.

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