EAS & Hearing Preservation

World's first EAS candidate was implanted already in the year 1999 and today this treatment is accepted all over the world. From the beginning crucial questions needed answers; is hearing preservation at cochlear implantation possible? How long/short can the electrode arrays be? Can one ear combine acoustic and electric input?

Today we have the answers to most of the questions that came with the EAS treatment, even if some of the questions have surprising answers. In the 90ties the Bruce Gantz group investigated EAS treatment with electrodes as short as 6mm, whereas the von Ilberg group used 18-20mm insertion depth in Germany. We know now that it is possible to preserve residual hearing (and thus the inner structures of the Cochlear) to a very high degree even with insertion depths way over 20mm.

One very interesting study from the Usami group in Japan shows the result of 32 consecutive hearing preservation cases. The objective was to evaluate hearing preservation and speech discrimination outcomes using MED-EL's FLEX24 electrode array (24mm) but also very long (31,5mm) electrodes (MED-EL’s STANDARD and FLEXSOFT). Using the EAS surgical technique 30 patients (2 bilateral cases) were treated.
**Results:** Postoperative evaluation after full insertion of the flexible electrodes (24 mm, 31.5 mm) showed that residual hearing was well preserved in all 32 ears. In all patients, speech discrimination and perception scores were improved postoperatively.

The study shows each patient’s hearing development over time. Here the first 9 cases.

*Figure 1.* Hearing preservation results of group 1 with FLEX24 electrode. The lines indicate preoperative, and 1, 3, 6, and 12 months postoperative audiograms. Shadow indicates the audiological criteria for electric acoustic stimulation (EAS) clinical trial.
Figure 2. (A) Average audiogram of group 1. The lines indicate pre-operative, 1, 3, 6, and 12 months postoperative audiograms. (B) Hearing level of group 1 with electric acoustic stimulation (EAS).

The figure below display the speech development over time for the 29 ears that fulfilled the EAS indication and which were implanted with a FLEX24 (24mm) electrode array:

Figure 5. Speech discrimination and perception scores of group 1 (with FLEX24 electrode). Speech discrimination and perception scores were improved postoperatively with electric acoustic stimulation (EAS). SNR, signal-to-noise ratio.
In the second group the patients were out of EAS criteria but still with substantial residual hearing in the lower frequencies. One of these patients was implanted with MED-EL's STANDARD electrode array (31.5mm) and two with FLEXSOFT (31.5mm). Postoperative the patients could still benefit from electric and acoustic stimulation.

The figure below display the speech development over time for the 3 ears that did not fulfill the EAS indication and which were implanted with a STANDARD or FLEXSOFT (both 31.5mm) electrode array. All ears had pre-operative and post-operative functional residual hearing so that the patients could benefit from electric and acoustic hearing.

![Figure 4. (A) Average audiogram of group 2. The lines indicate pre-operative, and 1, 3, 6, and 12 months postoperative audiograms. (B) Hearing level of group 2 with electric acoustic stimulation (EAS).](image)

![Figure 6. Speech discrimination and perception scores of group 2 (STANDARD electrode or FLEXSOFT electrode with less residual hearing). Speech discrimination and perception scores were improved postoperatively with electric acoustic stimulation (EAS). SNR, signal-to-noise Ratio.](image)
This paper concludes that the indication criteria of EAS can be extended. EAS hearing loss is more or less progressive which makes full insertion of medium/long electrodes a better solution in order to compensate for future hearing deterioration at the lower frequencies. The benefits of the EAS surgical approach are crucial not only for the patients with residual hearing but also from the aspect of structure preservation in patients with profound hearing loss without any residual hearing.

Usami et al. 2014; Hearing preservation and clinical outcome of 32 consecutive electric acoustic stimulation (EAS) surgeries