Supplementary Material

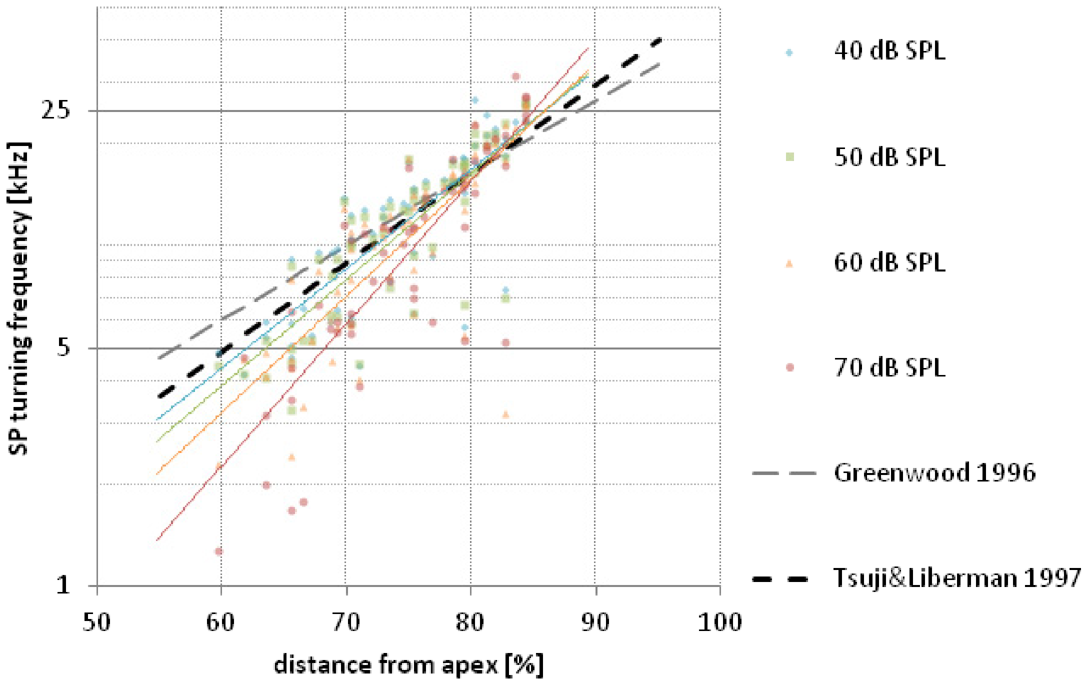

Fig. S1: Data comparison to place frequency maps by Greenwood (1990) and Tsuji & Liberman (1997)

The graphs illustrate a shallower slope of the frequency progression based on the Greenwood function, parameterized for the guinea pig, than for the adjusted function from Tsuji & Liberman. The SP turning frequencies calculated in the present study slope steeply for high sound levels (red regression, 70 dB SPL) and approach the slope of the Tsuji & Liberman function at lower sound levels (blue regression, 40 dB SPL). The slope of the Greenwood function is even shallower. Based on this observation we decided that the adjusted function presented a better fit to our data.
(Single points: all SP Ft data; colors: stimulus sound pressure levels; gray dashed line: Greenwood function, black dashed line: Adjusted function from Tsuji and Liberman)

Greenwood, D.D. (1990). A cochlear frequency-position function for several species--29 years later. *J Acoust Soc Am*, 87, 2592–605.

Tsuji, J., Liberman, M.C. (1997). Intracellular labeling of auditory nerve fibers in guinea pig: central and peripheral projections. *J Comp Neurol*, 381, 188–202.

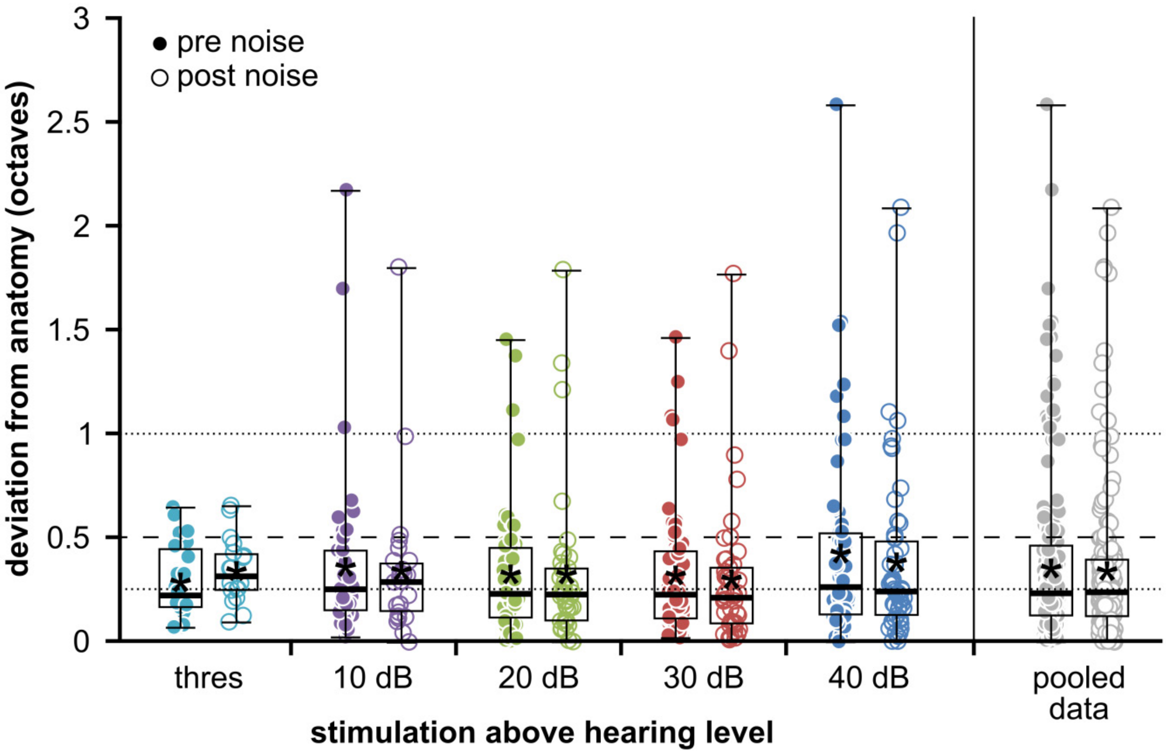

Fig. S2: Deviation from anatomical estimates was stable across stimulation levels.

The median values (bold black bars) were stable at values close to ¼ octave (lower dotted line) at all stimulation levels before (filled circles) and after (open circles) noise exposure (pooled data: both medians 0.24 octaves). The ¾ quartile in all but one cases (pre 40dB: 0.53 octaves) was below ½ octave (pooled data: pre: 0.47 octaves; post 0.40 octaves). Due to the skewed data distribution the meanvalues are 0.36 octaves (pre) and 0.34 octaves (post) respectively. The precision of the position estimate can therefore be assumed to be between 620 µm (0.24 octaves) and 930 µm (0.36 octaves) considering the slope of 2.59 mm/octave in the guinea pig (Greenwood 1990). The number of datapoints varies for the different sound levels (Fig. 5B).

Greenwood, D.D. (1990). A cochlear frequency-position function for several species--29 years later. *J Acoust Soc Am*, 87, 2592–605.

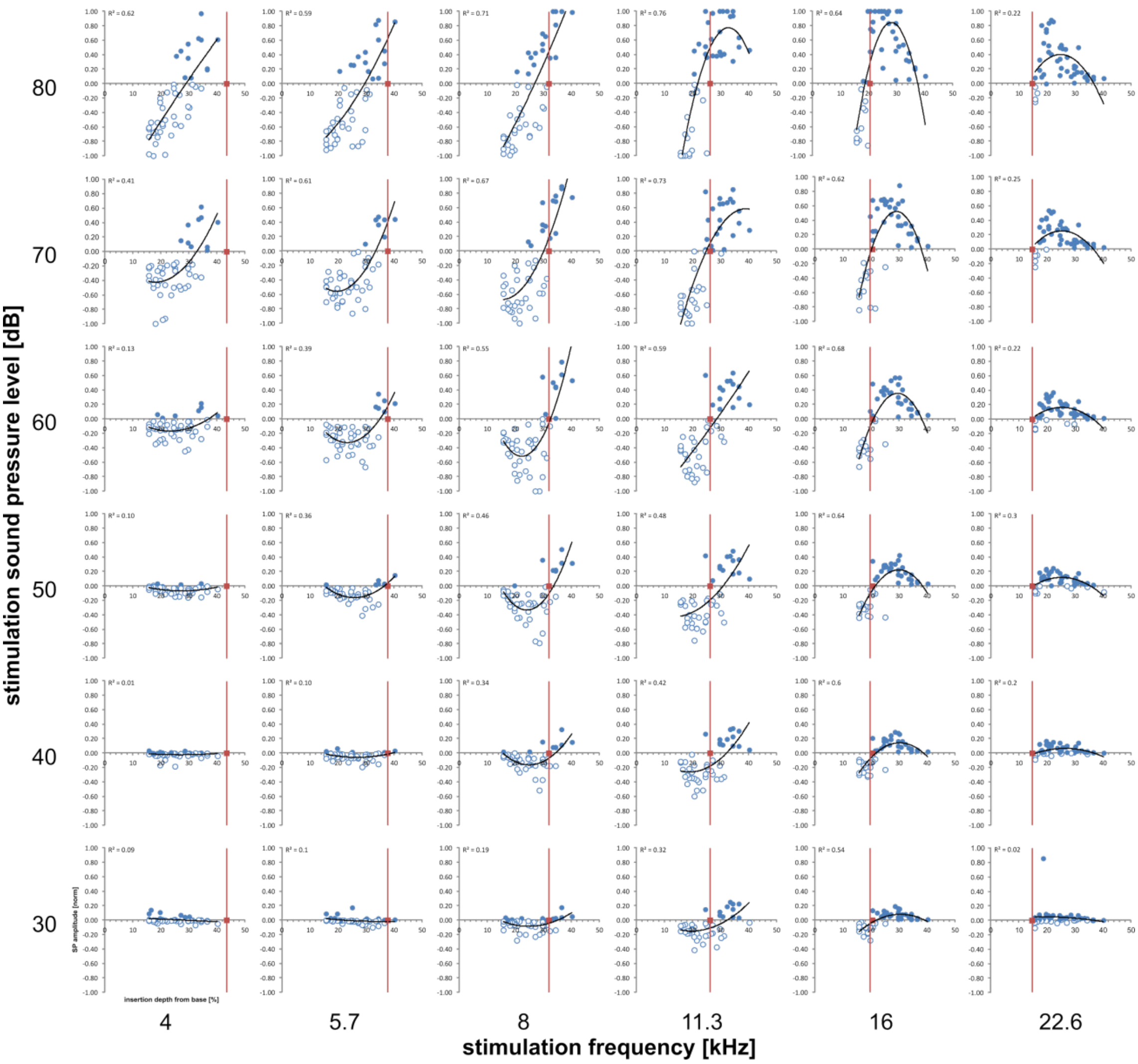

Fig. S3: The SP is stable across a broad stimulation range.

The grid in this figure expands on the data presented in Fig. 7. The data distribution for all recording positions is depicted for frequencies between 4 kHz and 22.6 kHz, covering the reconstructed full insertion depth from cochleostomy to 270° insertion. The frequency position according Tsuji and Liberman is indicated by the red marker. Negative SP amplitudes are indicated by open circles and positive SP thresholds are indicated by filled circles. Up to a sound level of 60 dB SPL the zero crossings of the SP amplitude align well with the estimated frequency position. At 70 dB SPL and 80 dB SPL the zero crossing occurs at electrode positions basally to the anatomical estimate. The data suggest stable positional estimate across various sound levels and frequencies on a group level as well as on an individual level, as seen e.g. at 8 kHz at 60 dB SPL, were virtually all data points basally to the anatomic frequency estimate are negative and all apically to it are positive.

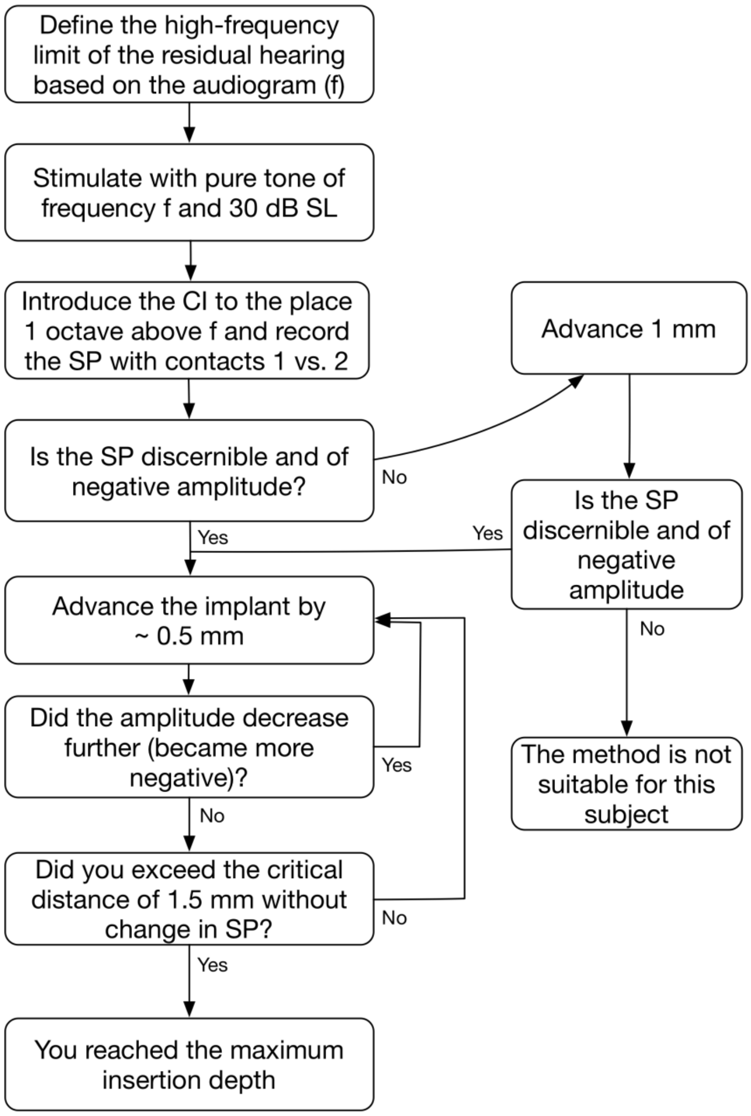

Fig. S4: Flow chart of a potential clinical application of bipolar SP measurements.

Intraoperative data could be use to monitor the approach of the electrode to a frequency or frequency region, predetermined form a pre-operative audiogram.