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COCHLEAR IMPLANTS

Effects of wind noise reduction on speech perception with the MED-EL Sonnet cochlear implant audio processor

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Abstract

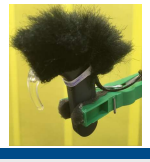
Introduction:
Speech understanding in wind remains a challenge for cochlear implant users because air flow at the microphone openings produces noise. Current cochlear implant (CI) audio processors feature algorithms intended to reduce wind noise.

Objectives

This study investigates three methods of wind noise reduction on speech perception in users of the MED-EL Sonnet audio processor:

- WNR- (wind noise reduction) algorithm of the Sonnet audio processor
- Reduction of apical stimulation levels by 30% (electrodes 1-5), w/o WNR ("Bass-30%").
- Fur windshield over the microphones, w/o WNR (see picture→)

Hypothesis: The reduction of wind noise improves speech perception.



Methods and Materials

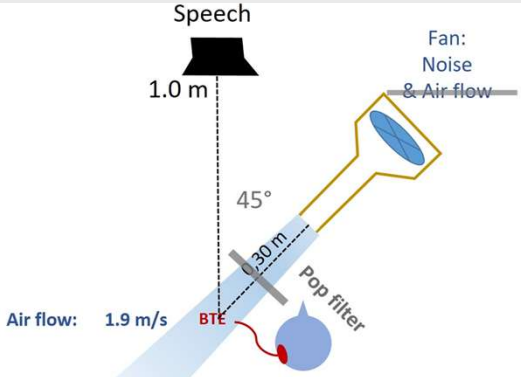


Fig. 1: Setup

- "Wind": Air flow from a Dyson fan with tube.
- "No wind": Dyson fan switched on, with pop filter in the air flow.
- BTE CI processor fixed separately from the head.

- Adults, post-lingually deafened.
- speech ≥55% monosyllables with CI
- N= 20 CI ears: 16 subjects, 12x unilateral, 4x bilateral.
- BTE: Sonnet / Sonnet-2,
- clinical map = base for all 3 study maps:
  1) WNR off
  2) WNR active strong
  3) WNR off and MCLs of apical 5 electrodes reduced by 30%,
  in all conditions: microphone natural; noise reduction mild
- acute tests
- OLSA (Oldenburg sentence test): adaptive speech level,
  constant noise level 46 dB =fan w/o air flow.
  Test: Speech level at 50% speech perception,
  =speech reception threshold (SRT).

Results

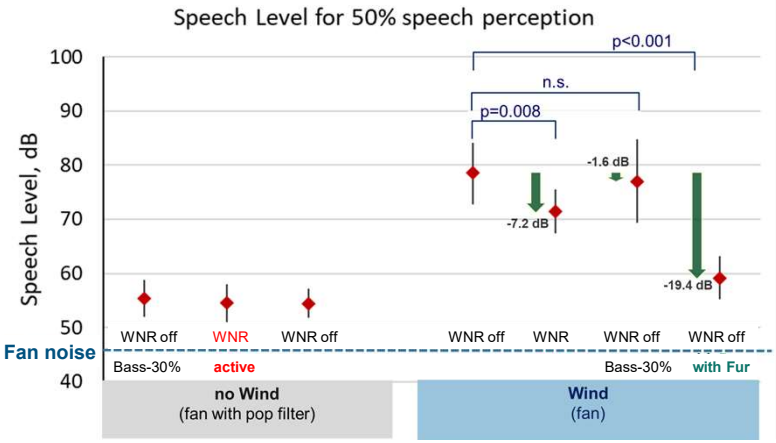


Fig. 2: Results, mean ±standard deviation.
Bass-30%: Reduction of apical stimulation levels.

- Main energy of the wind noise was below 1.2 kHz (Fig. 3)
- The WNR algorithm activates at a wind speed above 1.5 m/s (5.4 km/h).
- With the WNR algorithm active, the SRT decreases by 7.2 dB. (WNR strong), p=0.008, Wilcoxon signed-rank test.
- With the MCLs of apical electrodes reduced by 30% (Bass-30%) the SRT decreases by 1.6 dB, n.s.
- With the fur wind shield, the SRT decreases by 19.4 dB.

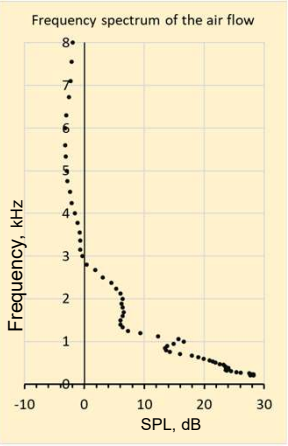


Fig. 3: Frequency spectrum of the air flow, measured via Sonnet (WNR off):
Sonnet in the air flow
− Sonnet with pop filter in air flow
= Frequency spectrum of air flow

Method:
Sonnet output connected to Verifit hearing aid test box.

Conclusion

The detrimental effect of wind on speech perception was partially compensated by the WNR algorithm. The mechanical wind shield (fur) was more effective than the WNR algorithm.

References

Hagen R et al. 2020. Microphone directionality and wind noise reduction enhance speech perception in users of the MED-EL SONNET audio processor. Cochlear Implants International 21(1):53-65.

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