PREVALENCE OF COCHLEAR DEAD REGIONS AMONG ADULT HEARING-IMPAIRED PATIENTS.

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Introduction

Cochlear Dead Regions (CDR) are areas of the basilar membrane with non-functioning inner hair cells. Moore et al (2004) proposed the TEN(HL) as a simple method to clinically identify CDRs.

It has been suggested that CDRs negatively impact the ability to utilize high-frequency speech cues, therefore, hearing aid high-frequency gain should be reduced for patients with CDR.

However, research on the effect of CDRs on speech intelligibility generally has been conducted on small subject samples with severe-to-profound hearing loss; a group not typically considered good candidates for amplification.

Few studies have reported the prevalence of CDR in patients with more moderate high-frequency hearing loss; a population considered better candidates for amplification.

Research Questions:

- What is the prevalence of CDR for patients who are more likely to be good hearing aid candidates?
- Can patients with CDR and a 60-90 dB high-frequency hearing loss utilize high frequency speech information?

Materials and methods

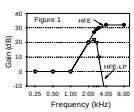
Subjects were a complete consecutive sample of patients presenting at a VA hospital. A group of subjects retrospectively sampled from private practices in Memphis were also tested.

Inclusion criteria

- Adults with sensorineural hearing loss in the better ear of 60-90 dB for at least part of the frequency range from 1-3 kHz.
- Thresholds no better than 25 dB in the better ear above 1000 Hz.
- Flat or sloping audiometric configuration (no rising configurations).
- Only ears that met inclusion criteria were tested, therefore some were tested in only one ear.

Tests

- CDR was assessed using the TEN(HL).
- Utilization of high-frequency speech cues was assessed using the QSIN. This test was presented with a high-frequency emphasis (HFE) or with a low-pass (LP) filter (see figure).



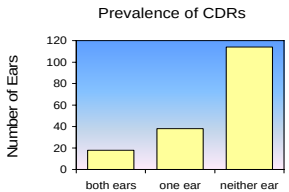
- Audibility of QSIN conditions was estimated using SII.

Subjects

- 170 subjects (307 ears) were tested
- M=99, F=71
- Mean age=74 yrs (39-96)

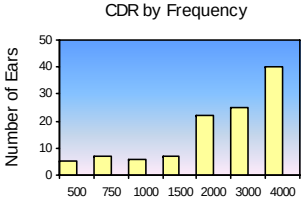
Prevalence of CDR

The TEN(HL) was used to measure masked thresholds at half octave intervals between 500 and 4000 Hz. Threshold in the TEN was considered abnormally high when it exceeded the expected level by 10+ dB (Moore et. al. 2004).



Prevalence		
Subject-wise	33% (56/170)	
Ear-wise	24% (74/307)	
Gender:	M	F
With CDR	35%	31%
Age	CDR	Non-CDR
	73 yrs (39-91)	74 yrs (49-96)

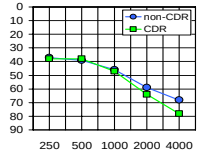
One-third of subjects tested positive for CDR. T-tests indicated no significant differences between groups for gender (p >.05) or age (p>.05)

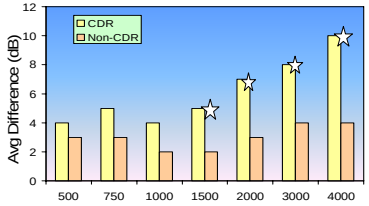


Most CDRs were found above 1500Hz. However, for some, dead regions were present at lower frequencies.

Characteristics of CDR and non-CDR Groups

Composite audiograms indicated ears with CDR had 5-10 dB more high-frequency hearing loss than ears without CDR. Differences between groups were significant above 1500 Hz. (p <.001).

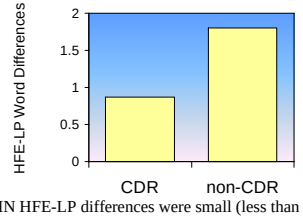




Larger differences between thresholds in the TEN and expected thresholds were observed with CDR ears than were seen with non-CDR ears. The differences were noted even at frequencies outside the dead region. Stars indicate significant differences between CDR groups (p=.000).

Utilization of high-frequency speech cues

Four QSIN lists were presented to one ear via insert phone at a "loud, but ok" level for HFE and LP conditions. If a CDR was present, the QSIN was tested in that ear; if there was no CDR, the best ear for amplification was tested.



QSIN HFE-LP differences were small (less than 2 words). But both CDR and non-CDR ears performed better when high-frequency speech cues were available.

Ears without CDR achieved significantly more benefit from high-frequency speech cues than ears with CDR, even when analysis controlled for audibility differences (p=.023).

Conclusions

- Using the TEN(HL) test with a 10+ dB criterion and a large sample of moderate-severe hearing-impaired adults, prevalence of cochlear dead regions is 33%. This is consistent with data reported by Preminger (2005) on a 49 subject sample.
- Neither age nor gender are predictive of cochlear dead regions.
- In general, ears with hearing loss suitable for amplification and a CDR, have slightly more high-frequency hearing loss than ears without a CDR.
- Thresholds in the TEN generally degrade more at all frequencies in ears with CDR than in non-CDR ears, not just in the frequencies where dead regions exist.
- Listeners with CDR appear to benefit from high-frequency speech cues, though not as much as listeners without CDR.
- QSIN data do not support the suggestion that high frequency gain should be reduced for patients with cochlear dead regions. However, additional research is needed to determine if benefit measured in the laboratory is observed in real-life.

References

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Acknowledgments

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For further information

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