Long-term evaluation of a new hearing aid supported tinnitus treatment

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Motivation

The upregulation of sensory gain and/or the degradation of inhibitory projections across hierarchical processing stages of the auditory pathway due to peripheral deprivation is likely to give rise to the auditory phantom percepts in Tinnitus.
Recently converging evidence showed that the suppression of neural hyperactivity by lateral inhibition using tailor-made notch filtering is a promising approach to support tinnitus treatments. In particular a 3-week pilot study using hearing aids proved to be successful. Until today a long-time evaluation of this approach was missing.

Methods

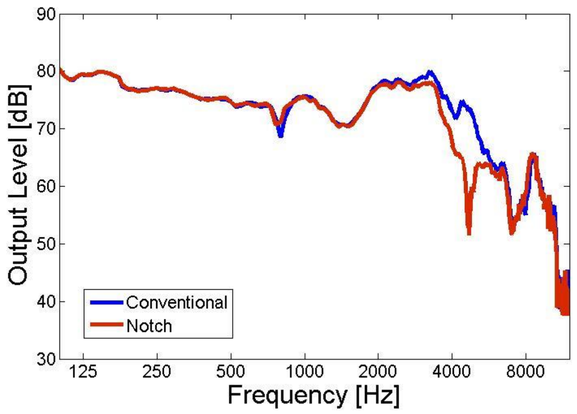

Fig 1: Hearing aid 2cc output measurement for conventional and notched fitting (e.g. 4.67 kHz notch; 70 dB sinus sweep)

Commercially available hearing aids were modified to block out the patients' individual tinnitus frequency to suppress tinnitus related changes in neural firing by lateral inhibition.

Notch characteristics:
- width = 0.5 octaves centered on individual tinnitus frequency
- depth = 25 dB

Study design

- double blinded 6-month clinical trial
- comparison of an individually adjusted tailor-made notch in the hearing aids amplification range (notched fitting) and unmodified conventionally fitted hearing aids of the same type (conventional fitting).

Experimental groups

	Conventional (n=15)	Notch (n=19)
Gender	5 female, 10 male	5 female, 14 male
Age	57 years (SD = 10.24 years)	56.21 years (SD = 10.31 years)
Tinnitus frequency: t=0 mo.	5.13 kHz (SD = 3.24 kHz)	4.29 kHz (SD = 1.92 kHz)
Tinnitus frequency: t=6 mo.	4.89 kHz (SD = 2.96 kHz)	3.52 kHz (SD = 2.84 kHz)
PTA tinnitus side	22.58 dB HL (SD = 11.22 dB HL)	25.26 dB HL (SD = 14.83 dB HL)
TQ12: t=0 mo.	16.13 (SD = 3.72)	15.63 (SD = 3.83)

Table 1: demographic and clinical characterization of the subjects

All patients suffered from a subjective chronic pure tone tinnitus (duration > 6 months, score of the tinnitus questionnaire TQ12 >= 10).

Results

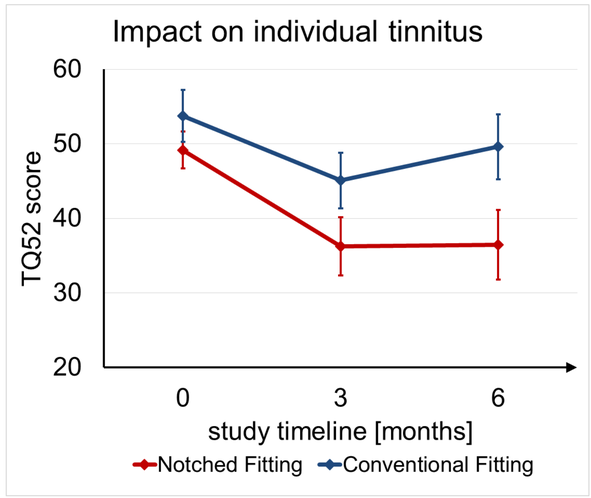

Fig. 2: Mean TQ52 scores (+/-SE) measured at 0, 3 and 6 months.

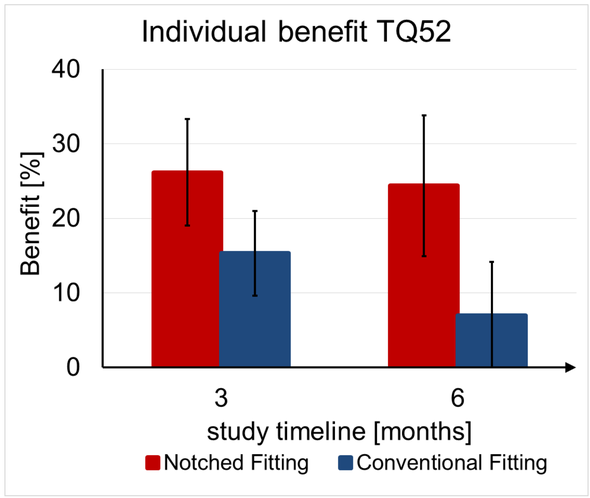

Fig. 3: Benefit of both treatments in percentage compared to their individual baseline at t = 0 months.

The notched fitting group showed a medium to large improvement compared to a conventional fitting as indicated by a Cohens d' = 0.62 after 6 months. After 3 months a considerable effect can be observed (Cohens d' = 0.49), too.

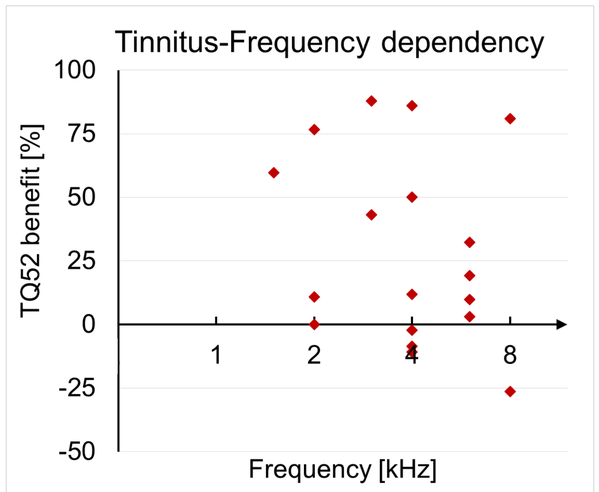

Fig. 4: TQ52 benefit in percentage at 6 months in relationship to the individual tinnitus frequency in the notch group.

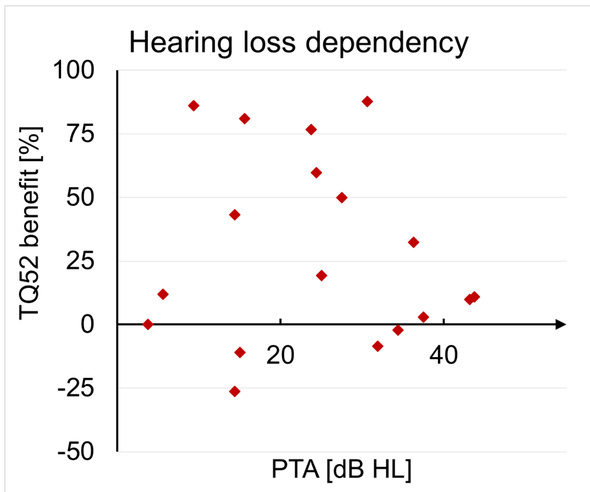

Fig. 5: TQ52 benefit in percentage at 6 months in relationship to the individual hearing loss in the notch group.

Conclusions

1) The study shows a therapeutic advantage of a tailored spectral notch in hearing aids in tinnitus in comparison to a conventional hearing aid fitting.
2) The therapeutic effect of spectrally modified acoustic stimulation is integrated into the patient's daily routine – no additional time for "therapy".
3) Treatment seems to work also for tinnitus being accompanied by slight - moderate hearing losses as indicated by PTA.
4) Treatment can also work for people suffering from severe chronic pure tone tinnitus.

➔ The individually adjusted notch implemented in the hearing aids is a promising alternative or an add-on for established tinnitus treatments.

References:

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