# Exploring the Benefits of Personal Remote Microphones in the Rehabilitation of Central Auditory Processing Disorder in Mitochondrial Disease Patients

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## BACKGROUND

- Auditory processing disorders impact speech perception, sound localisation, and temporal processing.
- These issues are common in Mitochondrial Disease (MD) and Friedreich's Ataxia.
- Conventional hearing aids often fail to address these challenges, particularly in noisy environments.
- Personal remote microphones (PRMs) show promise by improving speech perception through improved signal-to-noise ratios.
- Usability, ergonomics, and cost challenges remain barriers to widespread PRMs adoption.

**Aim**

To evaluate the potential benefits of hearing aids coupled with PRMs on speech perception in background noise, and assess usability and patient-reported outcomes over six weeks

## METHODS

**Sample:** 5 MD patients (m.3243A>G) with mild to moderate SNHL and APD. Group included 2 males and 3 females (mean age 52; SD = 10.10).

**Measures: PRM Efficacy**: Bamford-Kowal-Bench Speech-in-Noise Test (BKB-SIN) test with/without hearing aids, Roger Pen,

**Subjective Change**: Speech, Spatial, and Qualities questionnaire (SSQ), Listening Effort Assessment Scale (LEAS).
**Focus Group**: Feedback on PRM usability and challenges.

**Analysis:** SPSS 29 ($p<0.05$), One-way ANOVA (week 0 vs week 6), Repeated measures ANOVA (pre/post-test).

## RESULTS

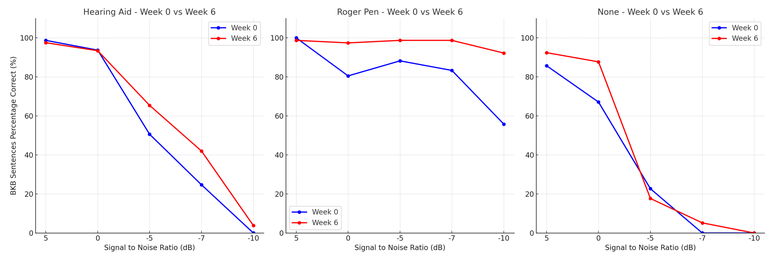


**Figure 1:** The graph compares the BKB sentence recognition percentages across different signal-to-noise ratios (dB) at Week 0 and Week 6, using Roger Pen, hearing aids, and no devices. Significant improvements were observed with the Roger Pen, especially in challenging listening conditions.

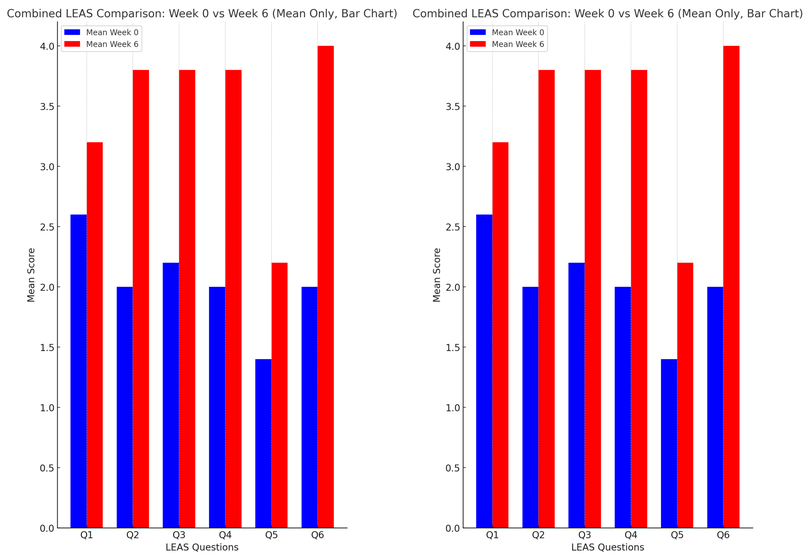


**Figure 2:** Mean SSQ scores for Speech, Spatial, and Qualities components at Week 0 and Week 6. No significant changes were observed across these components between the two time points ($p > 0.05$).
**Figure 3:** Mean LEAS scores for Week 0 and Week 6, covering effort in quiet (Q1), moderate noise (Q2), loud environments (Q3), fatigue (Q4), group conversations (Q5), and concentration in daily listening (Q6). A significant difference was observed between Week 0 and Week 6 ($p < 0.05$).

## DISCUSSION

- **Hearing rehabilitation challenges**: Patients with mitochondrial disease often face sensory overload and social isolation due to inadequate auditory care. Objective speech-in-noise testing showed that hearing aids were ineffective in signal-to-noise ratios below 0 dB, complicating rehabilitation.
- **PRM benefits**: Significant improvements in listening effort (LEAS) and BKB sentence scores were observed with the PRM in speech-in-noise perception.
- **Patient feedback**: Most participants reported overall improvements in speech clarity and listening effort. However, difficulties with setup and use in noisy environments were common.
- **Device limitations**: Complex settings and limited functionality in certain environments. A simplified, technology-integrated solution and adaptable PRM designs are needed.
- **Broader impact**: Early, individualised rehabilitation is essential to mitigate the link between hearing loss and cognitive decline, supporting better quality of life.

## REFERENCES

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