Does probe-tube verification of real-ear hearing aid amplification characteristics improve outcomes in adults? A systematic review and meta-analysis

Almufarrij I [1,2], Dillon H [1,4] and Munro KJ [1,3]

[1] Manchester Centre for Audiology and Deafness, School of Health Sciences, University of Manchester, UK
[2] Department of Rehabilitation Sciences, College of Applied Medical Sciences, King Saud University, Riyadh, Kingdom of Saudi Arabia
[3] Manchester University Hospitals NHS Foundation Trust, Manchester Academic Health Science Centre, UK
[4] Macquarie University, Sydney, Australia

INTRODUCTION

- Using a probe-tube microphone to measure and adjust the real-ear performance of the hearing aid to match the prescription target is recommended and widely used in clinical practice [1].
- Hearing aid fitting software can approximately match the amplification characteristics of the hearing aid to the prescription without real-ear measurements (REMs), but using REM improves the match to the prescribed target [2].
- What is unclear is if the improved match results in a better patient outcome.

Aim

- The objective of this review was to determine whether the use of REM improves patient outcomes in adult hearing aid users.

METHODS

- The protocol for this systematic review was pre-registered with the International Prospective Register of Systematic Reviews (PROSPERO; CRD42020166074) and published in BMJ Open [3].

Information sources

- Studies were identified using a systematic search strategy of the following databases: COCHRANE Library, Embase, Emcare, MEDLINE, PsycINFO, PubMed, and Web of Science.
- The search strategy was developed by a medical information specialist.

Eligibility criteria

- Adults (≥ 18 years old) with any specified degree of sensorineural or mixed hearing loss.
- The studies should compare REM fitting to the initial fit provided by the manufacturer's fitting software.
- Hearing-specific health-related QoL was the primary outcome
- Secondary outcomes included self-reported listening ability, speech recognition in quiet or nosiy setting, sound quality and preference.

Quality appraisal

- The risk of bias in the studies was evaluated using Down and Black's checklist [4]. The quality of the overall evidence was assessed using the Grading of Recommendations, Assessment, Development and Evaluations tool (GRADE) [5].

RESULTS

Search and selection of studies

- After assessing more than 1,420 records from seven databases, six experimental studies (published between 2012 and 2019), met the inclusion criteria; five were included in the meta-analyses.

Outcomes

- Our choice of primary outcome was not reported in any of the studies. Of the secondary outcomes, the following were reported:

a) Self-reported listening ability

- There was a small but statistically significant positive effect of REM, compared to the manufacturer's initial fit (standardized mean difference [SMD]: 0.22; Figure 1). The quality of evidence, as measured with GRADE, was judged to be moderate due to concerns over indirectness (i.e., short follow-up periods) and imprecision (i.e., small sample sizes) .

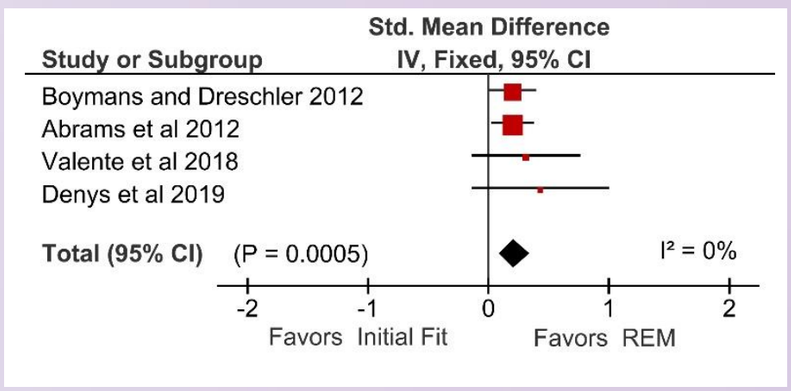

***Fig. 1** . Forest plot comparing self-reported listening ability with REM fitting vs initial fit. The size of the square denotes the weight of each study and the whiskers represent the 95% confidence interval (CI) around the effect size. Diamonds represent the pooled effect size and its 95% CI; IV = Inverse-variance weighting.*

b) Speech intelligibility in quiet and noisy settings

- There were moderate and small statistically significant positive effects of REM on speech intelligibility in quiet (SMD: 0.59) and in noise (SMD: 0.15). The evidence, for both outcomes, were judged to be of low quality due to concerns over indirectness, risk of bias (i.e., plausible carryover effect) and imprecision (Figure 2).

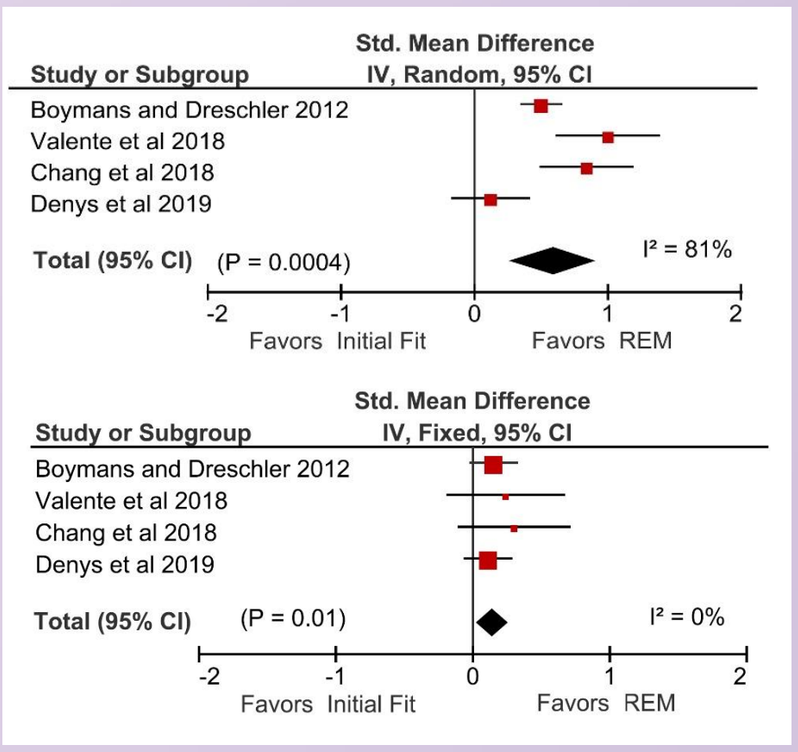

***Fig 2.** Forest plot comparing speech intelligibility in quiet (top panel) and noisy (bottom panel) settings with REM fitting vs initial.*

c) Sound quality

- There was a moderate but statistically non-significant positive effect of REM on sound quality (SMD = 0.51). The overall quality of evidence was downgraded to very low due to concerns over indirectness, risk of bias and imprecision (Figure 3).

d) Preference

- There was a moderate and statistically significant positive effect of REM, compared to the manufacturer's initial fit (proportion difference: 52.2%). The evidence was judged to be of a high quality because there are no serious limitations (Figure 3).

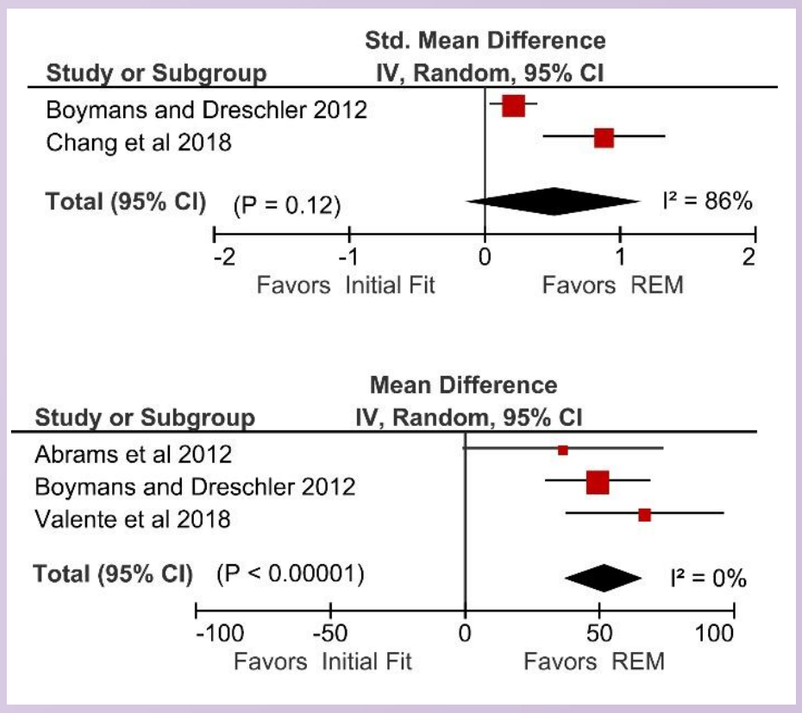

***Fig. 3** . Forest plot comparing sound quality (top panel) and preference (bottom panel) with REM fitting vs initial .*

TAKE HOME MESSAGES

- The review, the first on this topic, identified a small number of studies with limited numbers of participants.
- The quality of evidence range from high to very low, but favoured REM fittings for all outcomes.
- The statistical findings are encouraging but it is currently unclear if these are meaningful to the patient because minimum clinically important differences for the outcomes have yet to be established.
- This paper is currently under review for publication in Trends in Hearing.

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CONTACT DETAILS

ibrahim.almufarrij@manchester.ac.uk

Manchester Centre for Audiology and Deafness

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