

Critical Review: Is there any evidence of directional microphone benefit in open canal hearing aid fitting?

Iravani Gharavi, Z.
M.Cl.Sc (AUD) Candidate
University of Western Ontario: School of Communication Sciences and Disorders

This critical review examines the benefit of directional microphone in improving speech intelligibility in the presence of noise in open canal hearing aid fitting. Study design for all studies included in this critical review is single group (pre-post) with repeated measures. Overall, research suggests that a patient fitted with a directional hearing aid would require directional microphone in order to perform significantly better than unaided or aided with omnidirectional microphone for listening in noisy environments.

Introduction

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Objectives

The primary objective of this review is to critically evaluate existing literature examining the benefit of directional microphone in improving speech intelligibility in the presence of noise in open ear hearing aids. Literature including comparisons across unaided and aided conditions as well as in different listening situations (i.e. with and without noise) were assessed to determine clinical implications for using directional microphones in open ear fittings.

Methods

Search Strategy

Computerized databases, including MEDLINE/ID, CINAHL, SCOPUS, PubMed, were searched using the following strategy:

Pre-Posttest Study # 2: Unaided and Aided Performance with a Directional OpenFit Hearing Aid

The study conducted by Valente and Mispagel (2008) was aimed at measuring differences in performance between unaided and aided performance (omnidirectional and directional) by using an open-canal hearing aid (Vivatone Dual D44 from Vivatone Hearing System, LLC.) These differences were assessed by measuring reception thresholds for sentences (RTS in dB) using HINT test. Twenty-six adults (18 males; 8 females; mean age= 65.6 years; sd= 11.7 years) with no previous amplification experience were selected. Audiometric results indicated normal hearing at 250-500 Hz followed by slight to moderate severe bilateral symmetrical sensorineural hearing loss at 1000-8000 Hz. None of the participants had a conductive component. The directional microphone of the hearing aid has three fixed polar patterns (cardioid, hypercardioid, and bidirectional). Hyper-5(.9)34(r)-14(m)Td [((p)-7Td [((p).006 Tc ele-1.157 Td [500.009 Tw[(w4(pe) [510i(d

#1 and #3 the directional microphone benefit evaluated with or without noise reduction algorithm. Through critical analysis of the results of all three studies, it can be indicated that directional microphones with or without noise reduction technology indeed provide an advantage over omnidirectional microphones or unaided performance in open canal fittings. Although the aforementioned studies indicated that listeners fit with directional open canal hearing aids obtain better speech recognition in laboratory settings, further research is needed to determine the extent to which that benefit can be generalized to real world situations.

It should be noted that open canal hearing aid users do not need amplification in low frequencies and consequently low frequency directivity is not available for this hearing impaired population. Findings suggest that directional benefit is smaller in open canal hearing aids as compared to traditional occluded fittings. Nordrum et al, (2006) has reported a directional advantage of 3.5 dB over omnidirectional conditions using closed canal devices. Klemp and Dhar (2008) reported a smaller and statistically nonsignificant benefit of 3.32 dB using a similar comparison.

Conclusion

Outcomes from the studies explored in this critical review reveal significant directional microphone benefit with or without digital noise reduction algorithm compared to omnidirectional or unaided conditions in open canal hearing instrument fittings. Therefore, the directional signal processing should not be prevented in open canal instruments for listening in noisy environments.

Clinical implications

Given the assembled research materials, there is significant evidence supporting the benefit of directionality in open fit hearing aids. Patients meeting the selection criteria (i.e. fitting range of the hearing instrument) will most likely experience greater benefit from an open canal hearing aid with active directional microphones. Further studies need to include how much directional microphone benefit is needed for the hearing aid users in order to notice the difference between unaided, omnidirectional, or directional performance. Clinicians play an important role in this field. They involved in prescription of hearing

instruments and their associated technologies, as well as education and counseling with regards to the expected benefit of these technologies.

Clinicians need to attempt to provide appropriate evidence based hearing instrument prescription. The cost effectiveness of such technologies should be clearly shared with the clients. Clinicians should consider the directional microphone benefit open canal hearing aid fittings to increase speech intelligibility in noise. As clinicians, we must be informed of the efficacy of these technologies and update our knowledge about them.

Also, clinicians are the client's link with hearing instrument manufacturer and the researcher. It is the clinician responsibility to provide the client with unbiased and educated information about the newest technologies. Clients should be clearly informed that the directional microphone can offer better speech understanding in noise if the signal source is located in front and the signal source is relatively near. On one hand, counseling is needed surrounding the expected benefit. On the other hand, client education on the effective use of the technology is essential. Clients would benefit from the directional microphone technology more if they know how and when to implement it.

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