

Field trial of a novel modular open fit in-the-ear hearing instrument

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Open BTE fittings have gained a big market share in the last couple of years. However, there is still a considerable group of open fitting candidates who would prefer an in-the-ear solution that is not readily visible. While it is possible to build CIC hearing instruments with large vents, the “instant fit” advantage of the open BTE fittings is lost. To bridge this gap a novel modular in-the-ear system with external microphone placed in the cymba has been developed. This device allows instant fitting and it is uniquely designed to be “open” by allowing acoustic leakage around the casing, which is intended to aid in retention and reduce the size.

Methods and test subjects

The new device has been tested by 30 test subjects (10 CIC users, 10 open BTE users, and 10 persons having no experience with amplification) in a comprehensive field trial at the University of Giessen. The average pure tone audiogram of each subgroup was very similar with sloping losses from 20 dB in the low frequencies to about 60 dB in the high frequency range. Compared to the other subgroups, CIC users had on average about 15 dB more hearing loss at 2 kHz. The entire field trial took between 6 and 8 weeks with a fitting session at the beginning, and a test session in the middle and at the end of the trial. The first session included case history, otoscopy, documentation of own fitting, fitting and fine-tuning of the test devices, maximum stable gain test and hand-out of a series of questionnaires (APHAB, and inventories on satisfaction, wearing comfort, performance and cosmetics). In the middle session hearings aids were checked, photographed in situ and fine-tuned if needed, and real ear measurements and a telephone test were carried out. In the final session the devices were checked again, questionnaires were collected, and the occlusion effect was measured objectively and subjectively before speech recognition was measured in noise (speech recognition threshold measured with OLSA) for both unaided and aided (test devices, subject’s own aids) conditions.

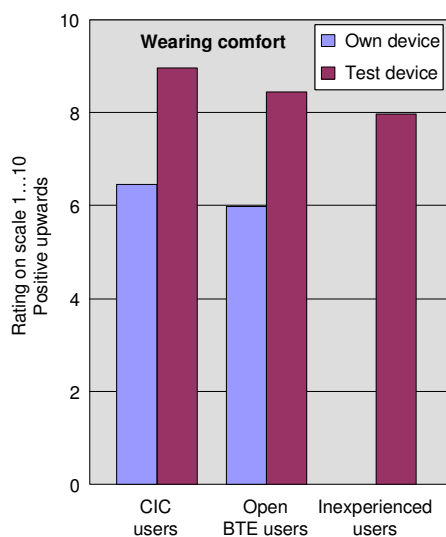


Fig. 1: Rating of wearing comfort of the novel device compared to subject’s own device.

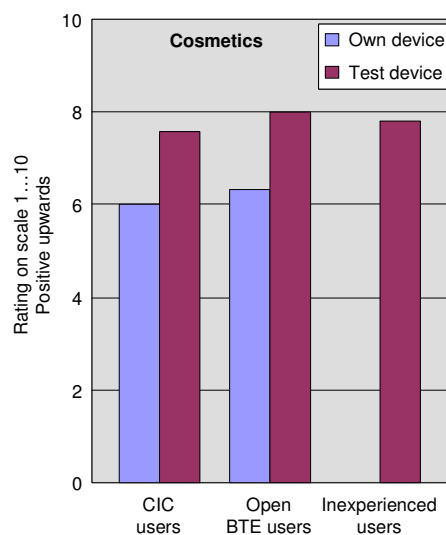


Fig. 2: Rating of cosmetics of the novel device compared to subject’s own device.

Results

The results of the laboratory measurements as well as the outcomes of the field trial show that this novel type of open in-the-ear solution was well accepted by the test subjects in terms of performance and benefit in everyday life, wearing comfort, cosmetics and handling. All groups of users demonstrated a significant ($p < .0001$) improvement in speech recognition scores on the OLSA over unaided. As expected, aided benefit was found to be similar to the participants' own devices for the open BTE and CIC groups of users. Both users of open BTE solutions as well as CIC users reported better wearing comfort (Fig. 1) and cosmetics (Fig. 2) with the new device compared to their own hearing aids. On top of this, CIC users in particular enjoyed considerable extra benefit with the novel device in terms of subjective/objective occlusion effect, speech understanding in noise, APHAB outcomes (Fig. 3), handling, appearance, sound clarity/naturalness, hearing improvement etc. (Fig. 4). Only telephone use might be a problem (feedback and speech intelligibility) in cases needing higher gain. Expectedly, open BTE users experienced less occlusion effect with their own fittings than with the test device.

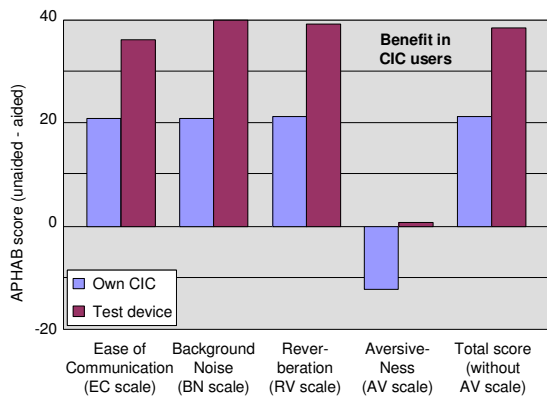


Fig. 3: Benefit in CIC users in terms of APHAB-subscores.

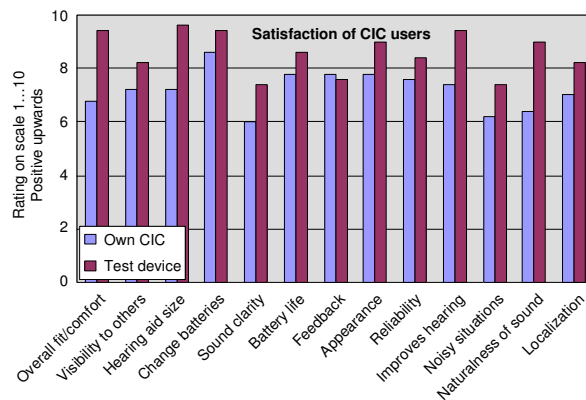


Fig. 4: Satisfaction of CIC users in terms of handling, appearance, sound clarity/naturalness, hearing improvement etc.

Conclusions

In this study the test devices were fit to hearing losses extending to 60-70 dB in the high frequencies. Results supported that this device provides amplification benefit equivalent to known types of hearing instruments. While the user's acceptance of the novel hearing device was found to be generally very high, some feedback problems in special listening situations such as using the phone were revealed. The outcomes of this study demonstrate that a product like this can be an interesting option for quite a big target group with mild-to-moderate sensorineural hearing loss. If the size of the ear canal allows an appropriate placement of the modular system the end user can enjoy attractive cosmetics and open acoustics in an instant fit in-the-ear hearing instrument.