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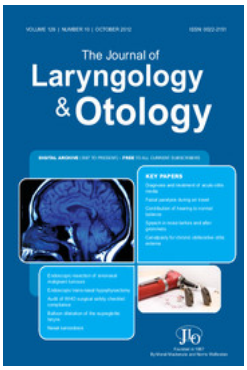

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The Future of ORL-HNS and Associated Specialties Series

The future of audiological rehabilitation

David M. Baguley, Linda M. Luxon*

Abstract
The field of audiological rehabilitation in adults faces an array of opportunities. Some of these are technological, as with the advent of fully digital hearing-aids, and some involve clinical practice, such as opportunities for true multidisciplinary working, and for changes in hearing-aid prescription and provision. The development of well-validated questionnaire instruments should facilitate robust research into the effectiveness of clinical interventions in adult audiological rehabilitation, for such evidence is urgently needed if the field is to thrive.

Key words: Audiological rehabilitation; Hearing aids, digital; Evidence-based medicine

Introduction

The history of audiological rehabilitation is an interesting and varied field, with many pioneers and technological breakthroughs to celebrate. At no point in that history, however, has there been such an exciting, and perhaps bewildering array of opportunities and developments as there is at the present time. The objective of this article is to briefly review the opportunities, and indeed threats, that are evident in the discipline of adult audiological rehabilitation and to propose how these might be utilized for the benefit of hearing-impaired individuals. In order to describe the extent of the opportunities in this field this article has been structured in sections considering how audiological handicap can be determined quantitatively and qualitatively (thus facilitating better definitions of audiological handicap, disability and impairment), advances in techniques and technology, models of multidisciplinary practice, and the present paucity of evidence of effectiveness. Various trends are extrapolated from the recent past, but the authors agree with Edmund Burke (1729–1797) in that:

> 'You can never plan the future by the past'

and so expect their vision of the future to be superseded by yet more exciting events and opportunities.

Quantifying handicap and benefit

The nature of the handicap experienced by an individual with a hearing impairment, and indeed by that individual's friends, family and colleagues, is complex and specific to that individual. This has meant that many clinicians working with such individuals came to rely upon intuitive judgments about rehabilitation needs and goals. Such clinical acumen has a place in both audiology and otology,[1] but should ideally be complemented by quantitative data from well-normed and validated questionnaires. The ability to perform baseline assessments in audiological rehabilitation, and then to describe the effects of intervention has been a major advance, and augurs well for the future.

In assessing the handicap associated with a hearing loss, the hearing handicap inventory (HHIA)[2] and the many similar instruments (see Noble[3] for a comprehensive review), provide the ability to quantify self-perceived hearing functions. The research undertaken in this area is impressive, and includes deliberation on the relationship between the terms 'handicap', 'disability' and 'impairment'.[3,4]

In assessing the benefit of a clinical intervention the above instruments provide the ability to undertake before and after repeat measures. Some questionnaires have been developed for particular interventions, such as hearing aid fitting. The Glasgow Hearing-Aid Benefit Profile[5] and the abbreviated profile of hearing-aid benefit (APHAB)[6] provide good examples of such instruments, and are becoming widely used.

An alternative approach is the use of open-ended questions,[7] that allow the individual to express all of the issues associated with their hearing impairment.

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This approach provides qualitative data about a patients self-perceived situation, and has been proposed as a useful adjunct to quantitative data.[8]

Thus a body of work has been undertaken that allows the quantitative and qualitative determination of handicap and of benefit in audiological rehabilitation. This work is fundamental both to future studies which shall explore the effectiveness of rehabilitation strategies,[9] and to the application of strategies in an individual that address their specific concerns and issues.

Techniques and technology

The introduction of fully digital hearing-aids promises to be a dramatic influence upon audiological rehabilitation. Whilst digitally programmable hearing-aids facilitated the fitting of difficult hearing losses, the signal processing technology remained analogue. The latest generation of hearing-aids which utilize digital technology throughout the signal processing pathway allow noise management strategies and complex loudness compensation algorithms to be implemented.[10] Thus, these devices better meet the needs of the majority of individuals with cochlear hearing loss who not only have raised auditory thresholds, but also have altered loudness perception, reduced temporal and frequency resolution and impaired localization ability.[11] These advances in hearing aid practice have been well publicised, and have raised the expectations of patients informed by the media and the internet.

Other hearing-aid advances have involved bone anchored hearing-aids[12] and hearing-aid transducers attached to the ossicular chain.[13,14] Whilst candidature for such devices is strict, one should expect this technology to become more widely available, though in the latter case evidence of safety and efficacy is not yet complete.

Technological innovation is not restricted to hearing-aids however. Wilson[15] in a review of the future of cochlear implants, described speech processing strategies and stimulation strategies that when implemented hold promise for the increase in the quality of sound perceived by the user. In addition the confident application of cochlear implants in individuals with moderate/severe sensorineural hearing loss[16] means that many will benefit from these techniques in the future. Another technical advance is the application of auditory brainstem implants in patients with neurofibromatosis type 2[17,18] that holds the promise of some hearing sensation for patients with this condition.

Whilst the technological developments described may prove to be beneficial to hearing-impaired individuals in the longer term, it may well be a change in clinical practice that is most effective in the near future. The use of real ear insertion gain measurements for hearing-aid fitting and verification has been limited in the United Kingdom because of the extraordinary pressure upon Departments of Audiology. This has resulted in many sub-optimal hearing-aid fittings,[19] and has surely been a contributory factor to the non-use of many hearing-aids. There are indications that the use of verification techniques in hearing-aid fitting are becoming more widespread, and the existence of such well-evaluated hearing-aid prescription formulae as NAL and NAL-NL1,[20,21] desired sensation level, known as DSL[22] and the newer DSL I/O for non-linear hearing-aids,[23] FIG6[24] and the Cambridge formulae[25,26] means that appropriate hearing-aid fitting can be undertaken without difficulty in the majority of cases. All of these formulae now vary the amount of target gain as a function of input level, rather than by thresholds alone[27] and thus allow the fitting of low threshold compression aids. Without such changes in clinical practice, the potential benefits of digital hearing-aids may not be realised.[28]

Each of the exciting areas of technological development as described holds promise for the hearing impaired: but at a price. Whilst cochlear implant services were initially well funded, there is some recent anecdotal evidence of adults who are suitable for implantation having to wait, or for that intervention to be denied on grounds of cost. Audiology in the United Kingdom has traditionally been under resourced, and whilst at the time of writing the introduction of a limited trial of digital hearing-aids on the NHS is being discussed the scale of investment needed, not least in training, is daunting.

It should be noted that whilst the under resourcing of services for hearing-impaired individuals in the UK is regrettable, in many areas of the world the situation is far worse. The prospect of digital hearing-aid technology for the first world is exciting, but advances in the implementation of programmes involving prevention of hearing impairment and provision of basic hearing-aid technology for less affluent nations would be equally welcome.

Multidisciplinary practice

Given the multifaceted nature of adult audiological rehabilitation, it should not be surprising that no one professional group possesses all the skills needed in this demanding area of clinical practice. The skills and abilities of medical staff, audiologists and hearing therapists, clinical scientists, speech and language therapists and psychologists are complementary. In an ideal setting there are opportunities for synergy between the clinical practice of each of these professionals to the immense benefit of hearing-impaired individuals. It should be acknowledged however that audiology in the United Kingdom falls short of this ideal, and there have been, and continue to be, some professional conflicts. These can only have a negative impact upon patient care, and are an unedifying sight. The development of true multi-disciplinary teams, with no one profession adopting priority or power over any other remains a challenge, but one that the authors are confident will be addressed in the next decade. The example set by many multi-disciplinary cochlear implant teams working with mutual respect and collaboration is indicative of the potential for success.

Evidence of effectiveness

Evidence-based medicine (EBM) provides a rigorous and robust framework for the evaluation of a clinical intervention.[29] Repeatable evidence from well-designed randomized controlled trials is required, and the paucity of such evidence in audiological rehabilitation[30] is a significant weakness. This is particularly troubling when placed against the need for investment in audiological rehabilitation, particularly if digital hearing-aids are to be introduced in an effective manner. Whilst there are a number of trials of digital versus analogue hearing-aid technology in the literature,[31,32] the majority of these would not withstand a rigorous EBM evaluation and were not in fact designed for that purpose.

Audiological rehabilitation is far from alone in this situation, but this position cannot be maintained. The implementation of studies of clinical effectiveness of audiological intervention, using the well validated questionnaire instruments described in conjunction with more traditional tests is urgent.[33,34]

Conclusion

The future of adult audiological rehabilitation appears bright, with opportunities for improved practice in many areas. These benefits will only be achieved, however, if supported by an evidence base, training, and appropriate resources.

References

1 Moffat DA, Baguley DM, Beynon GJ, Da-Cruz M. Clinical acumen and vestibular schwannoma. *Am J Otol* 1998;**19**:82–7

2 Newman CW, Weinstein BE, Jacobson GP, Hug GA. The hearing handicap inventory for adults: psychometric adequacy and audiometric correlates. *Ear Hear Res* 1990;**11**:430–3

3 Noble W. *Self-assessment of Hearing and Related Functions.* London: Whurr Publishers, 1998

4 Arnold P. Is there still a consensus on impairment, disability and handicap in audiology? *Br J Audiol* 1998;**32**:265–71

5 Gatehouse S. The Glasgow Hearing Aid Benefit Profile: derivation and validation of a client-centred outcome measure for hearing aid services. *J Am Acad Audiol* 1999;**10**:80–103

6 Cox RM, Alexander GC. The abbreviated profile of hearing aid benefit. *Ear Hear Res* 1995;**16**:176–86

7 Barcham LJ, Stephens SDG. The use of an open ended problems questionnaire in auditory rehabilitation. *Brit J Audiol* 1980;**14**:49–54

8 Zhao F, Stephens SDG. Hearing complaints of patients with King-Kopetzky syndrome (obscure auditory dysfunction). *Brit J Audiol* 1996;**30**:397–402

9 Gagne JP, McDuff S, Getty L. Some limitations of evaluative investigations based solely on normed outcome measures. *J Am Acad Audiol* 1999;**10**:46–62

10 Schweitzer C. Development of digital hearing aids. *Trends in Amplification* 1997;**2**:41–77

11 Moore BCJ. Perceptual consequences of cochlear hearing loss and their implications for the design of hearing aids. *Ear Hear Res* 1996;**17**:133–61

12 Tjellstrom A, Hakansson B. The bone-anchored hearing aid. Design principles, indications, and long-term clinical results. *Otolaryngol Clin North Am* 1995;**28**:53–72

13 Goode RL, Rosenbaum ML, Maniglia AJ. The history and development of the implantable hearing aid. *Otolaryngol Clin North Am* 1995;**28**:1–16

14 Lenarz T, Weber BP, Mack KF, Battmer RD, Gnadeberg D. Vibrant Soundbridge System: Ein neuartiges Horimplantat fur Innenohrschwerhorige. Teil 1: Funktionsweise und erste klinische Erfahrungen. *Laryngorhinootologie* 1998;**77**:247–55

15 Wilson BS. The future of cochlear implants. *Brit J Audiol* 19997;**31**:205–26

16 Fraysse B, Dillier N, Klenzner T, Laszig R, Manrique M, Morera Perez C, *et al.* Cochlear implants for adults obtaining marginal benefit from acoustic amplification: a European study. *Am J Otol* 1998;**19**:591–7

17 Otto SR, Brackmann DE, Staller S, Menapace CM. The multichannel auditory brainstem implant: 6 month coinvestigator results. *Adv Otorhinolaryngol* 1997;**52**:1–7

18 Laszig R, Marangos N, Sollmann WP, Ramsden RT. Central electrical stimulation of the auditory pathway in neurofibromatosis type 2. *Ear Nose Throat J* 1999;**78**: 110–1, 115–7

19 Swan IR, Gatehouse S. The value of routine in-the-ear measurement of hearing aid gain. *Br J Audiol* 1997;**29**:271–7

20 Byrne D, Dillon H. The National Acoustic Laboratories' new procedure for selecting the gain and frequency response of a hearing aid. *Ear Hear Res* 1986;**7**:257–65

21 Dillon H. NAL-NL1: a new procedure for fitting nonlinear hearing aids. *Hearing J* 1999;**52**:10–6

22 Seewald RC, Ross M, Spiro K. Selecting amplification characteristics for young hearing impaired children. *Ear Hear Res* 1985;**6**:48–53

23 Cornelisse LE, Seewald RC, Jamieson DG. The input/output formula: a theoretical approach to the fitting of personal amplification devices. *J Am Surg Assoc* 1995;**97**:1854–64

24 Killion MC, Fikret-Pasa S. The three types of sensorineural hearing loss: loudness and intelligibility considerations. *Hearing J* 1993;**46**:31–6

25 Moore BC, Glasberg BR. Use of a loudness model for hearing-aid fitting. I. Linear hearing aids. *Br J Audiol* 1998;**32**:317–35

26 Moore BC, Alcantara JI, Stone MA, Glasberg BR. Use of a loudness model for hearing aid fitting: II. Hearing aids with multi-channel compression. *Br J Audiol* 1999;**33**:157–70

27 Ricketts TA. Fitting hearing aids to individual loudness perception measures. *Ear Hear Res* 1996;**17**:124–32

28 Naylor G. Technical and audiological factors in the implementation and use of digital signal processing hearings. *Scand Audiol* 1998;**26**:223–9

29 Sackett DL, Richardson WS, Rosenberg W, Haynes RB. *Evidence-based Medicine: How to Practice and Teach EBM.* New York: Churchill Livingstone, 1997

30 Robinson K. Evidence-based medicine and its implications for audiological science. *Br J Audiol* 1999;**33**:9-16

31 Berninger E, Karlsson KK. Clinical study of Widex senso on first time hearing users. *Scand Audiol* 1999;**28**:117–25

32 Arlinger S, Billermark E, Oberg M, Lunner T, Hellgren J. Clinical trial of a digital hearing aid. *Scand Audiol* 1998;**27**:51–61

33 Arlinger SD. Clinical assessment of modern hearing aids. *Scand Audiol* 1998;**(Suppl 49)**:50–3

34 Gatehouse S. Speech tests as measures of outcome. *Scand Audiol Suppl* 1998;**49**:54–60

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