

An intra-individual comparison of the previous conventional hearing aid with the bone-anchored hearing aid: the Nijmegen group questionnaire

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Abstract

By spring 2000, a total of 351 patients were implanted in the Birmingham bone-anchored hearing aid (BAHA) programme. This group consisted of 242 adults and 109 children. The aim of this retrospective questionnaire study was to directly assess patient satisfaction with their current bone-anchored hearing aid in comparison with their previous conventional air and/or bone-conduction hearing aids.

The Nijmegen group questionnaire was sent by post to 312 patients who used their BAHA for six months or longer. The questionnaire used was first described by Mylanus *et al.* (Nijmegen group) in 1998. The total response rate was 72 per cent (227 of 312 patients). The bone-anchored hearing aid was found to be significantly superior to prior conventional hearing aids in all respects.

Key words: Hearing Aids; Osseointegration; Questionnaires; Patient Satisfaction

Introduction

The percutaneous bone-conduction hearing aid was first developed by Hakansson in 1985.¹ The bone-anchored hearing aid (BAHA) connects directly to an osseointegrated titanium percutaneous implant anchored within the temporal bone. In a minor surgical procedure this implant is fitted under local anaesthetic. Sound vibration is then transferred from the transducer directly to the skull base thus giving direct bone conduction.

Sensorineural hearing loss is the most common form of hearing impairment. Conductive hearing loss is a second, less common, type of hearing deficit that may be suitable for surgical correction. If not, these patients are usually fitted with either conventional air or bone conduction hearing aids. Difficulties arise when hearing loss is further complicated by chronic otitis media, otitis externa and congenital aural atresia. In these particular situations, an ear mould is difficult or impossible to use. In such patients the introduction of the bone-anchored hearing aid has proved to be invaluable.^{2,3} Conventional bone-conduction hearing aids are a less popular option because of their poor aesthetic appearance, comfort, frequency response and inadequate gain.²

In this study patients were asked to compare their current bone-anchored hearing aid with their previous conventional hearing aid.

Patients and methods

The questionnaire used in this study was first designed, validated and used by Mylanus *et al.* in 1998 (Appendix 1).⁴

The Nijmegen group compared the BAHA to the patients' previous air-conduction hearing aids. However, our study uses the same questionnaire to compare the BAHA to the previous conventional air-conduction (AC) or bone-conductor (BC) aid.

To avoid 'enthusiasm' bias and initial difficulties with fitting and maintenance of their bone-anchored hearing aid, only those subjects who had worn a bone-anchored hearing aid for six months or more were included in this study. A total of 312 patients were sent the postal questionnaire. A waiting period of four months was allowed for return of completed questionnaires. A small cohort of the patients (15 in number) used bilateral BAHA implants. These patients were instructed to fill in the questionnaires with reference to the use of their first BAHA (longest worn).

The binomial test (data in non-parametric scales) was applied to the results for statistical analysis.

Results

Three hundred and fifty-one patients were implanted in the BAHA programme. There were 187 males and 164 females. The age range was two to 67 years.

TABLE I
DISTRIBUTION OF RESPONSE RATES

Total number of implantees	351
Total included in the study	312 (6 months or more of BAHA use)
Total excluded	39 (less than 6 months of BAHA use) (31 adults, 8 children)
Total respondents	227 (72% response rate)
Total non-respondents	85
Adults (211)	187 respondents (89%) 24 non-respondents (11%)
Children (101) (under 16 years)	40 respondents (40%) 61 non-respondents (60%)

TABLE II
WHICH HEARING AID IS BETTER WITH REGARD TO

Parameter	BAHA	AC/BC Aid	Significance (Binomial test)
a. Occurrence of ear infections (reduced)	72.8%	2.4%	$p < 0.001$
b. Speech recognition – Quiet	79.3%	4.7%	$p < 0.001$
c. Speech recognition – Noise	59.2%	6.5%	$p < 0.005$
d. Sound quality	78.7%	8.3%	$p < 0.001$
e. Visibility	70.4%	7.7%	$p < 0.001$
f. Handling	81.8%	4.7%	$p < 0.001$
g. Feedback problems	75.1%	4.7%	$p < 0.001$
h. ENT visits	70.4%	3%	$p < 0.001$

BAHA – Bone-anchored hearing aid
AC aid – Air-conduction aid
BC aid – Bone-conductor aid

A total of 312 patients were included in the study, and 227 (72 per cent) questionnaires were completed and returned. Of the 85 non-respondents, 61/85 (72 per cent) were children. Patients that returned completed questionnaires had worn their BAHA for a period of six months to 11 years (mean 5.8 years). Table I illustrates the distribution of the response rates.

Patients found the bone-anchored hearing aid to be significantly superior in all respects when compared to their previous conventional hearing aids (air-conduction or bone-conductor) as depicted in Table II. Fifty-eight out of 227 patients (25 per cent) had used a bone-conductor (BC aid) at some stage of hearing rehabilitation. Fourteen per cent of respondents found no difference with regards speech recognition in noisy surroundings and 12 per cent found handling of the BAHA to be similar to their previous aids.

When asked to identify the most positive distinguishing feature of their BAHA, 179 (79 per cent) of 227 respondents believed sound quality to be the

most outstanding feature ($p < 0.001$). One hundred and sixty-three (72 per cent) respondents were pleased with the reduced number of ear infections ($p < 0.001$). One hundred and seventy-nine (79 per cent) felt speech in quiet surroundings was improved, and 133 (59 per cent) had similar feelings regarding speech in a noisy environment (Figure 1).

Forty-five (20 per cent) of respondents felt that visibility was the most negative finding. Twenty-three (10 per cent) believed speech in noise and the number of visits to the ENT department to be the most negative aspects of the BAHA (Figure 2).

The health of the titanium implant and the ultimate success of the BAHA depend heavily upon the meticulous care and cleaning of the abutment. The cleaning of the BAHA was not really regarded as a problem by 146 (64 per cent) of respondents ($p < 0.001$) (Figure 3). Finally, the overwhelming majority of patients 189 (83 per cent) preferred the BAHA ($p < 0.001$) (Figure 4).

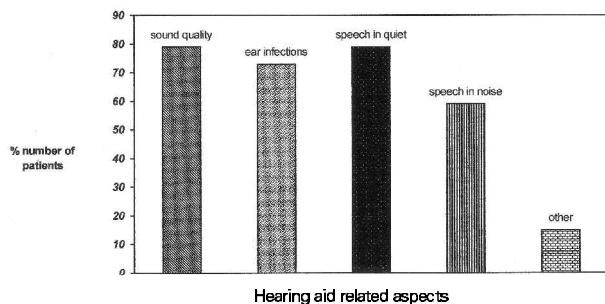


FIG. 1

Hearing aid related aspects with which BAHA distinguishes itself in a positive sense

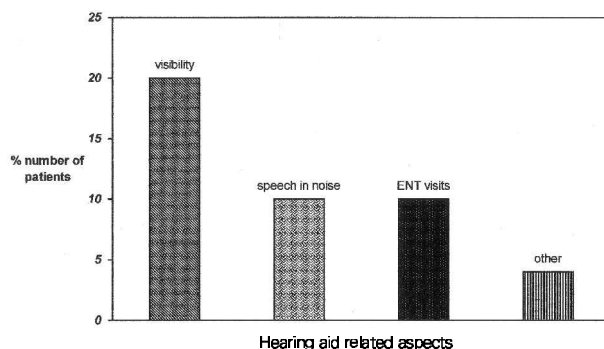


FIG. 2

Hearing aid related aspects in which the BAHA distinguishes itself in a negative sense

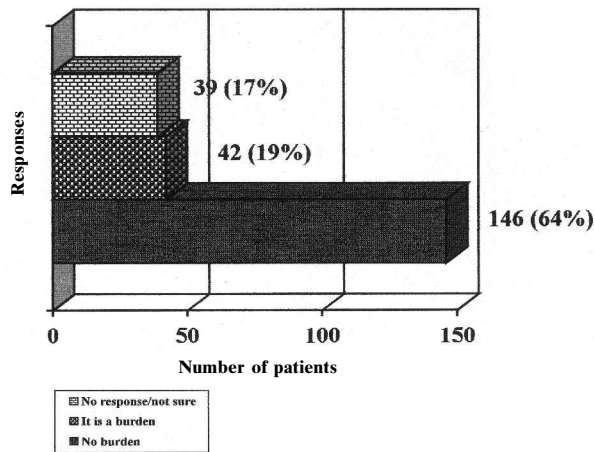


FIG. 3

Cleansing and care of the implant site and surrounding skin

Discussion

Bone-conduction hearing aids were first described in the 18th century.⁵ Today a conventional bone-anchored hearing aid consists of a transducer and amplifier attached to a headband or spectacle frame. It is designed to press firmly against the skull vault. These hearing aids have remained unpopular due to their poor aesthetics, discomfort due to constant pressure from the transducer, and poor sound quality at higher frequencies. The alternative bone-anchored hearing aid was first described by Hakanson in 1985¹ and became commercially available in 1987. The introduction of this titanium implant system by Branemark represented an important breakthrough in establishing both excellent device retention and also reaction-free penetration of the skin.

Today audiological testing is utilized to evaluate hearing aid performance, however these results do not always correlate to the patient's own perception of their hearing aid. This study presents the subjective results of an intra-individual comparison between the bone-anchored hearing aid and previously worn conventional hearing aids (air-conduction – AC, or bone-conductor – BC) of patients in the largest BAHA programme in the UK.

Each patient included in the study had worn a bone-anchored hearing aid for a period of six months to 11 years (mean 5.8 years). Some bias was expected from patients who had worn their bone-anchored hearing aid for many years. Memories of previous hearing aids fade with time and may affect the response to the questionnaire. The underlying otological conditions included congenital aural atresia, chronic otitis media, chronic otitis externa, large mastoid cavities, otosclerosis and an intolerance to alternative hearing aids. The model of bone-anchored hearing aid used by each patient was not identified in this study.

Of the 85 non-respondents, 61/85 (72 per cent) were paediatric patients. The questionnaire does appear to be primarily aimed at the adult patient and questions such as sound quality were difficult for paediatric subjects to both interpret and answer even

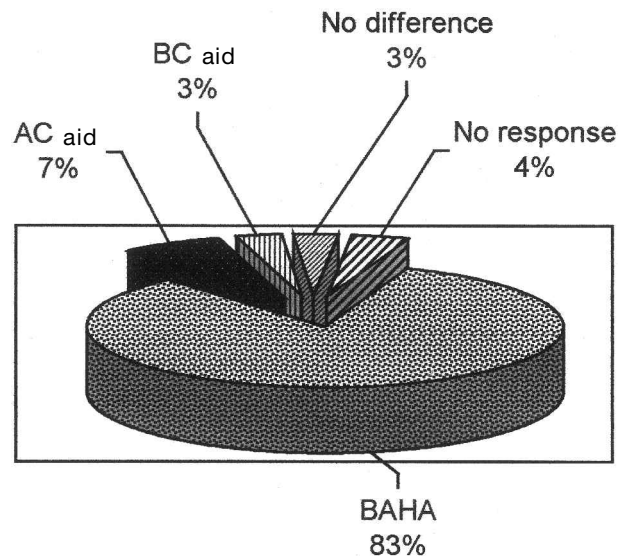


FIG. 4

The hearing aid that is preferred the most

BAHA – Bone-anchored hearing aid

AC aid – Air conduction aid (conventional)

BC aid – Bone conductor aid (conventional)

with help from parents. An attempt to cleave data into adult and paediatric groups did not prove satisfactory as some of the children who were implanted when they were under 16 years of age had since moved on to the adult programme. In general, the responses of both adult and paediatric groups were comparable. Similarly, comparison of the patient satisfaction with respect to the model of the BAHA used, i.e. BAHA Classic (all generations) and the BAHA Cordelle produced comparable results (data not in figures and tables). The data was again complicated by the fact that a significant number of patients had used various models for variable periods of time, with the company (Entific Medical Systems, Nobel Biocare, Nobel Pharma) upgrading the devices at various stages.

The BAHA was found to be better than both the air and bone conduction hearing aids in all aspects. However, the main advantages appeared to be sound quality and reduced ear infections. Speech in quiet surroundings was also considered to be greatly improved with the use of the bone-anchored aid. These findings are in keeping with published literature.^{2,6-8} Visibility of the BAHA was found to be the most negative finding. The number of visits to the out-patient clinic and the quality of speech in noise were also believed to be negative factors. Additional patient comments stated that the frequency of out-patient visits was only a problem in the early post-operative period.

Cleansing of the BAHA abutment is vitally important if osseointegration is to be maintained. Patients about to undergo implantation are routinely informed of the need of partner co-operation with

cleaning the fixture especially in the early post-operative weeks. In this study, cleaning was not found to be a problem to 64 per cent of respondents.

Finally, the overall preference was overwhelmingly found to be for the BAHA over other hearing aid types.

Conclusions

Seventy-three per cent of patients with previous discharging ears had fewer ear infections with the BAHA. Seventy-nine per cent of the respondents perceived better speech in quiet and 59 per cent better speech in noise with the BAHA.

Seventy-eight per cent of BAHA users liked the quality of sound with the BAHA. Sixty-four per cent of the users did not perceive care of the implant site as a burden. An overwhelming 83 per cent of the respondents preferred BAHA to their previous hearing aids.

Acknowledgements

We would like to thank Miss Joanne Foster, Research and Development Department, Post-Graduate Education Centre, Stepping Hill Hospital, Stockport, UK for all her help with the statistical analysis for this paper.

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Miss A-L McDermott takes responsibility for the integrity of the content of the paper.

Competing interests: None declared

Appendix 1

The Nijmegen questionnaire

An intra-individual comparison of the bone-anchored hearing aid and previous air conduction hearing aids.

1. Which hearing aid is better with regard to:-

A. Occurrence of ear infections	AC aid	BAHA	No difference
B. Speech recognition in quiet places	AC aid	BAHA	No difference
C. Speech recognition in noisy surroundings	AC aid	BAHA	No difference
D. Sound quality	AC aid	BAHA	No difference
E. Visibility	AC aid	BAHA	No difference
F. Handling	AC aid	BAHA	No difference
G. Feedback problems	AC aid	BAHA	No difference
H. ENT visits	AC aid	BAHA	No difference

2. On which of these hearing aid related aspects A to H does the BAHA distinguish itself most from the previous hearing aid in a positive sense?

3. On which of these hearing aid related aspects A to H does the BAHA distinguish itself most from the previous hearing aid in a negative sense?

4. Do you regard cleansing of the implant and the surrounding skin as a burden?

5. In general, which hearing aid do you prefer?

AC hearing aid	BAHA	No difference
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Comments:
