

The Glasgow benefit inventory in the evaluation of patient satisfaction with the bone-anchored hearing aid: quality of life issues

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Abstract

The Birmingham osseointegration programme began in 1988 and during the following 10 years there were a total of 351 bone-anchored hearing aid (BAHA) implantees. In the summer of 2000, a postal questionnaire study was undertaken to establish the impact of the bone-anchored hearing aid on all aspects of patients' lives.

We used the Glasgow benefit inventory (GBI), which is a subjective patient orientated post-interventional questionnaire especially developed to evaluate any otorhinolaryngological surgery and therapy. It is maximally sensitive to any change in health status brought about by a specific event: in this case the provision of a BAHA.

A total of 312 bone-anchored hearing aid patients, who had used their aids for a minimum period of six months, were sent GBI questionnaires. Two hundred and twenty-seven questionnaires were returned and utilized in the study. The results revealed that the use of a bone-anchored hearing aid significantly enhanced general well being (patient benefit), improved the patient's state of health (quality of life) and finally was considered a success by patients and their families.

Key words: Hearing Aids; Osseointegration; Patient Satisfaction; Evaluation Studies; Questionnaires; Quality of Life

Introduction

The bone-anchored hearing aid has provided an alternative to conventional air and bone conduction hearing aids particularly in situations of chronic middle-ear infections, congenital aural atresia and chronic otitis externa.¹

Since 1977 osseointegrated implants have been shown to provide excellent retention for the bone-anchored hearing aid. During the past 24 years these alternative hearing aids have become increasingly popular. The hearing aid component has recently been manufactured as a more compact device, thus improving its aesthetic appearance.

In a minor surgical procedure, performed under local anaesthesia for the majority of patients, a titanium fixture is implanted into the temporal bone. The periosteum of this implant site is removed and the surrounding subcutaneous tissue trimmed. A percutaneous abutment is then attached to the fixture. Three months later, the bone-anchored hearing aid is connected to the abutment. This simple implant technique has made the provision of these bone-anchored hearing aids less traumatic for the patient and overall, more cost-effective.

The Birmingham BAHA programme has implanted both paediatric and adult patients. An

evaluation of patient satisfaction and quality of life after BAHA implantation was undertaken.

Patients and methods

The GBI questionnaire along with a pre-paid envelope was sent to each patient, irrespective of their age, for completion in their own homes. This questionnaire was described by Robinson *et al.* in 1996² and consisted of 18 questions (Appendix 1). The questionnaire was designed to be completed either at interview or by the patient in their own home.

These 18 questions were based on a five-point Likert scale. Half of the questions ranged from a large deterioration in health status to a large improvement in health status. The design of the other half of the questions was reversed. This was to control response bias. The original 18-question GBI was first scored into a total score. It was then scored into the three subscales: (1) 12 questions relating to general factors; (2) Three questions relating to social support issues; (3) Three questions concerning physical health.

Two additions were made to our questionnaire: Four questions relating to the success of the BAHA (Appendix 2) and a 10 cm linear analogue scale reflecting state of health before and after BAHA

TABLE I
DISTRIBUTION OF RESPONSE RATES

Total number of implantees	351 (242 adults and 109 children)
Total included in the study	312 (6 months or more of BAHA use)
Number excluded	39 (less than 6 months of BAHA use) (31 adults and 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%)

(Appendix 3). Neither of these modifications was described in the original GBI strategy.

The total score for each patient was calculated and then averaged to give equal weight to each question. Three (no change) was subtracted from the total and the result multiplied by 50 to produce a benefit score. All these scores ranged from -100 to +100. The same analysis was used for each of the subscales.

The Wilcoxon signed ranks test was used to evaluate the linear analogue scale since it took into account not only the signs of the differences but also their magnitude.

This study was a retrospective postal questionnaire with a four month waiting time for responses from the 312 patients. Subjects who had worn their BAHA for more than six months were included in the study. This was to avoid an initial 'enthusiasm bias', allow a gradual learning process with the BAHA and to obviate initial difficulties with fitting and maintenance. 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).

Results

In 1988 the Birmingham bone-anchored hearing aid programme was started and during the following decade a total of 351 patients were implanted.

This study group consisted of 242 adults and 109 paediatric patients. The adult age range was 17 to 67 years (median age 45 years) and the paediatric range was two to 16 years (median age nine years). One hundred and eighty-seven patients were male and 164 were female.

Thirty-nine bone-anchored hearing aid patients had worn their hearing aid for less than six months and so they were excluded from the study. Three hundred and twelve GBI questionnaires were issued and 227 were completed and returned (72 per cent). Of the 85 non-respondents, 61/85 (72 per cent) were children. The patients that returned the questionnaire had used their BAHA for a period of six months to 11 years (mean 5.8 years). Table I illustrates the response rate of the study group.

This GBI questionnaire was initially shown to measure the change in health status (benefit) from various otolaryngological interventions.³⁻⁶ In our study, the benefit of wearing a bone-anchored hearing aid (quality of life), the success of wearing such a hearing aid and a measure of the health status both prior to, and after, wearing their bone-anchored hearing aid was evaluated.

The GBI questionnaire comprised of 18 questions each consisting of five-answer stems known as a five-point Likert scale ranging from a large change for the worse to a large change for the better (Table II). In the original paper describing the GBI, the score from the Likert scale was then transposed onto a benefit scale ranging from +100 to -100. The same analysis was utilized for the data in this study. In scoring the GBI, all responses to individual questions were averaged so that each question carried equal weight. The data were not distributed normally and so median values were calculated.

Table III shows the results of the questionnaire. Patient benefit was found to be significantly improved following implantation with a bone-anchored hearing aid. In no situation did provision of a bone-anchored hearing aid result in a deterioration of health. When asked about the success of their bone-anchored hearing aid, the overwhelming response was extremely positive (Table IV and Figure 1). A remarkable 167 (74 per cent) would encourage others with a similar condition to wear a bone-anchored hearing aid.

Figure 2 represents the summary of the results of the 18 question GBI. It shows the results of each of the three individual subscales. The data are displayed as 'Box and Whisker' plots. In each group the median and 25th and 75th percentiles are displayed. In all three groups the results were very encouraging.

The 10 cm linear analogue scale was included in the questionnaire to directly address the state of health both before and after, obtaining a bone-anchored hearing aid (Appendix 3). For analysis of this linear analogue scale the (non-parametric) Wilcoxon signed ranks test was used. This showed that the improved state of health of the patients following the use of a bone-anchored hearing aid to be highly significant (Table V).

Discussion

The GBI questionnaire is a patient-orientated questionnaire designed initially to consist of 18 post-intervention questions. It provides a measure of patient benefit (change in health status) from

TABLE II
EXAMPLE OF A QUESTION USED IN THE GLASGOW BENEFIT INVENTORY QUESTIONNAIRE

<i>How successful do you think your BAHA is?</i>	
A Great or moderate failure	(score 1)
B Partial failure	(score 2)
C No change	(score 3)
D Partial success	(score 4)
E Great or moderate success	(score 5)

TABLE III
RESULTS OF GBI QUESTIONNAIRE

Question	Median	Interquartile range	No. of each answer				
			5	4	3	2	1
a. Effect on life	5	(4.0, 5.0)	131	51	40	3	2
b. Overall effect on life	5	(4.0, 5.0)	137	60	23	2	3
c. Optimism about future	4	(4.0, 5.0)	102	62	56	3	1
d. Embarrassment with BAHA	4	(3.0, 5.0)	108	64	42	6	3
e. Self confidence with BAHA	4	(4.0, 5.0)	101	70	47	5	1
f. Dealing with company	4	(4.0, 5.0)	95	85	38	4	2
g. Support from friends	3	(3.0, 4.0)	29	39	136	15	5
h. Visits to GP	3	(3.0, 4.0)	32	46	136	7	2
i. Confidence-Job opportunities	3	(3.0, 4.0)	44	62	96	11	7
j. Self consciousness	4	(3.0, 4.0)	52	75	72	15	10
k. People who care	3	(3.0, 3.0)	19	24	174	3	4
i. Frequency of illness	3	(3.0, 4.0)	23	54	140	3	4
m. Frequency of medication	3	(3.0, 3.0)	17	37	152	14	5
n. Self-opinion	4	(3.0, 5.0)	75	94	47	6	2
o. Family support	3	(3.0, 4.0)	24	44	147	9	1
p. Inconvenience	4	(4.0, 5.0)	84	88	38	11	2
q. Social activities	4	(3.0, 4.0)	30	86	95	12	2
r. Social situations	4	(3.0, 5.0)	63	65	77	14	6

TABLE IV
SUCCESS OF BAHA

Question	Median	IQ range	No. of each answer				
			5	4	3	2	1
a. Success of BAHA	5	(4.0, 5.0)	170	45	3	3	4
b. Pleased/disappointed	5	(4.0, 5.0)	187	24	2	6	6
c. Family opinion	5	(4.0, 5.0)	159	48	9	4	5
d. BAHA recommendation	5	(4.0, 5.0)	168	43	7	3	3

IQ range = Inter-quartile range

otorhinolaryngological procedures. It was first developed in 1996 by Robinson *et al.*² The GBI allows a comparison of benefit across different interventions.³⁻⁶ It is designed to measure change in health status, where health status is defined as the general perception of well-being. This includes total psychological, social as well as physical well-being.⁷

In this study the modified GBI questionnaire consisted of 22 questions and a linear analogue scale. A response rate of 72 per cent was achieved. This included both adult and paediatric patients (Table I).

In response to the modification of the GBI (Appendix 2), these four additional questions regarded the success of the bone-anchored hearing

aid. Patients recorded a maximum change for the better (Figure 1). The bone-anchored hearing aid was a success. There appeared to be no change with regards to the number of visits to the GP, support of family and friends and confidence with regards job opportunities. Interestingly, many patients reported annoyance at being asked such questions (Appendix 4). They felt fully supported and cared for by their family and friends irrespective of the type of hearing aid worn. All remaining questions revealed the bone-anchored hearing aid to have a positive effect

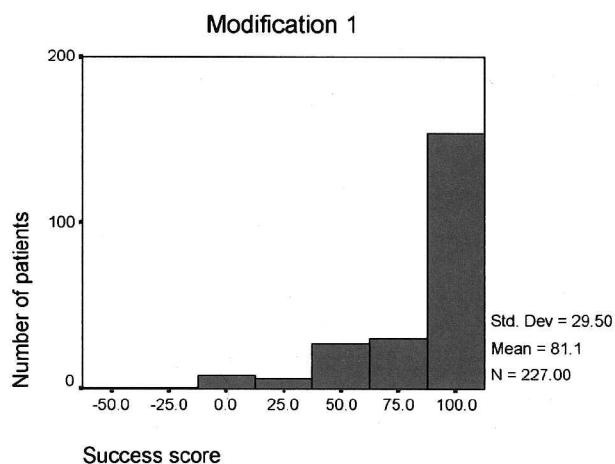


FIG. 1
Success of BAHA.

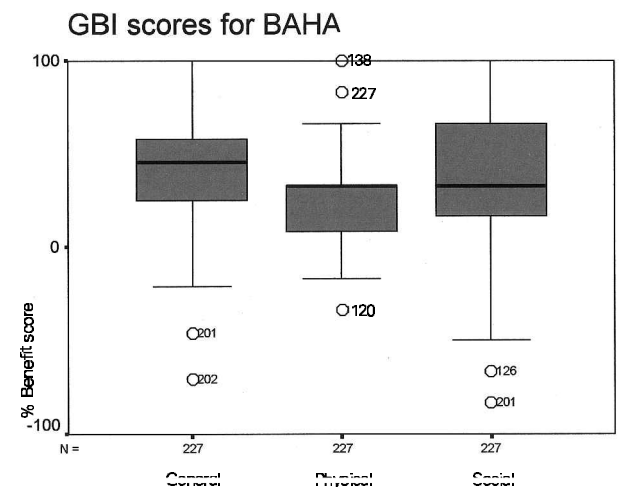


FIG. 2
Benefit scores of BAHA using the GBI (Questions a-l were about general benefit, m-o were about the physical benefit and finally p-r pertained to the social benefit.

TABLE V
VISUAL ANALOGUE SCALE REGARDING STATE OF HEALTH BEFORE AND AFTER BAHA

	State of health pre-BAHA	State of health post-BAHA	Difference
Median	56	85	15
Inter-quartile range	(45, 76)	(72, 91)	(0, 30)

Wilcoxon signed ranks test ($p < 0.001$)

on their health status. This was supported by the very significant results of the linear analogue scale $p < 0.001$ (Appendix 3 and Table V).

This study did not compare different otolaryngological procedures; it was simply used to establish the effect of the bone-anchored hearing aid on patient health status. In the validation study by Robinson *et al.* cochlear implantation was one of the interventions evaluated.² The GBI was found to be responsive to cochlear implantation. Its use for evaluating hearing aid devices was recommended. Only one other study in the literature discusses the use of the GBI following the provision of the bone-anchored hearing aid.⁸ Our study is on a large group of patients using the BAHA and the results were overwhelmingly supportive for the use of the bone-anchored hearing aid.

This study was a retrospective postal questionnaire. Some of the patients in the study had worn their bone-anchored hearing aid for 10 years. Memories of problems prior to their bone-anchored hearing aid may have faded with time and this of course may be reflected in the results. The GBI is not very sensitive to changes in health status following provision of the bone-anchored hearing aid; it is designed as a benefit questionnaire. The addition of the linear analogue scale has provided details of the health status both before, and after, provision of the hearing aid.

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. However, 72 per cent of the non-respondents were children. 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.

Finally, patient benefit was found to be improved by wearing the bone-anchored hearing aid and it significantly improved patient health. The study shows the bone-anchored hearing aid to be a success. Since the provision of such an aid involves a minor surgical procedure that can be performed with local anaesthesia, the authors suggest it should be considered more often for patients with chronic otorrhoea and otosclerosis.

Conclusion

An overwhelming majority of the patients, that included both adults and children, reported a high degree of satisfaction with the bone-anchored hearing aid. Improved self-confidence, better job opportunities and better participation in social activities were some of the 'quality of life' issues that were highlighted. The GBI proved to be a valuable instrument in evaluating patient satisfaction and quality of life after BAHA implantation.

Acknowledgements

The authors would like to thank Miss Joanne Foster B.Sc., Ph.D., Research and Development Department, Postgraduate Centre, Stepping Hill Hospital, Stockport, UK., and Professor Stuart Gatehouse, Institute of Hearing Research, Glasgow, UK. for their help with the statistical analysis of this paper.

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Mr S. Dutt takes responsibility for the integrity of the content of the paper.

Competing interests: None declared

Appendix 1**The Glasgow Benefit Inventory (GBI) Questionnaire**

This questionnaire asks how things have changed since you received your BAHA

- a) Has getting a BAHA affected the things you do?
Option 1 Much worse
Option 2 A little or somewhat worse
Option 3 No change
Option 4 A little or somewhat better
Option 5 Much better
- b) Has getting a BAHA made your overall life better or worse?
Option 1 Much better
Option 2 A little or somewhat better
Option 3 No change
Option 4 A little or somewhat worse
Option 5 Much worse
- c) Since you received your BAHA, have you felt more or less optimistic about the future?
Option 1 Much more optimistic
Option 2 More optimistic
Option 3 No change
Option 4 Less optimistic
Option 5 Much less optimistic
- d) Since you received your BAHA, do you feel more or less embarrassed with a group of people?
Option 1 Much more embarrassed
Option 2 More embarrassed
Option 3 No change
Option 4 Less embarrassed
Option 5 Much less embarrassed
- e) Since you received your BAHA, do you have more or less self-confidence?
Option 1 Much more self-confidence
Option 2 More self-confidence
Option 3 No change
Option 4 Less self-confidence
Option 5 Much less self-confidence
- f) Since you received your BAHA, have you found it easier or harder to deal with company?
Option 1 Much easier
Option 2 Easier
Option 3 No change
Option 4 Harder
Option 5 Much harder
- g) With your BAHA, do you feel that you have more or less support from your friends?
Option 1 Much more support
Option 2 More support
Option 3 No change
Option 4 Less support
Option 5 Much less support
- h) With your BAHA, have you been to your family doctor for any reason, more or less often?
Option 1 Much more often
Option 2 More often
Option 3 No change
Option 4 Less often
Option 5 Much less often
- i) Since you received your BAHA, do you feel more or less confident about job opportunities?
Option 1 Much more confident
Option 2 More confident
Option 3 No change
Option 4 Less confident
Option 5 Much less confident
- j) Since you received your BAHA, do you feel more or less self-conscious?
Option 1 Much more self-conscious
Option 2 More self-conscious
Option 3 No change
Option 4 Less self-conscious
Option 5 Much less self-conscious
- k) Since you received your BAHA, are there more or fewer people who really care about you?
Option 1 Many more people
Option 2 More people
Option 3 No change
Option 4 Fewer people
Option 5 Much fewer people

- l) Since you received your BAHA, do you catch colds or infections more or less often?
Option 1 Much more often
Option 2 More often
Option 3 No change
Option 4 Less often
Option 5 Much less often
- m) Since you received your BAHA, have you had to take more or less medicine for any reason?
Option 1 Much more medicine
Option 2 More medicine
Option 3 No change
Option 4 Less medicine
Option 5 Much less medicine
- n) Since you received your BAHA, do you feel better or worse about yourself?
Option 1 Much better
Option 2 Better
Option 3 No change
Option 4 Worse
Option 5 Much worse
- o) Since your BAHA, do you feel that you have more or less support from your family?
Option 1 Much more support
Option 2 More support
Option 3 No change
Option 4 Less support
Option 5 Much less support
- p) Since your BAHA, are you more or less inconvenienced by your hearing problem?
Option 1 Much more inconvenienced
Option 2 More inconvenienced
Option 3 No change
Option 4 Less inconvenienced
Option 5 Much less inconvenienced
- q) Since your BAHA, have you been able to participate in more or fewer social activities?
Option 1 Many more activities
Option 2 More activities
Option 3 No change
Option 4 Fewer activities
Option 5 Many fewer activities
- r) Since your BAHA, have you been more or less inclined to withdraw from social situations?
Option 1 Much more inclined
Option 2 More inclined
Option 3 No change
Option 4 Less inclined
Option 5 Much less inclined
-

Appendix 2

Modifications: subjective opinions regarding success of BAHA

- a) How successful do you think your BAHA is?
 Option 1 Great or moderate failure/1
 Option 2 Partial failure/2
 Option 3 No change/3
 Option 4 Partial success/4
 Option 5 Great or moderate success/5
- b) Do you feel pleased or disappointed about getting a BAHA?
 Option 1 Greatly or moderately pleased/5
 Option 2 A little or somewhat pleased/4
 Option 3 No change/3
 Option 4 A little or somewhat disappointed/2
 Option 5 Greatly or moderately disappointed/1
- c) How successful do members of your family and close friends think your BAHA is?
 Option 1 Great or moderate success/5
 Option 2 Partial success/4
 Option 3 No change/3
 Option 4 Partial failure/2
 Option 5 Great or moderate failure/1
- d) If you knew that someone else in your family or a close friend had a similar condition to yours, would you encourage them to get a similar BAHA?
 Option 1 Definitely not/1
 Option 2 Probably not/2
 Option 3 Can't decide/3
 Option 4 Probably yes/4
 Option 5 Definitely yes/5
-

Appendix 3

Modification: state of health before and after BAHA

We would like you to indicate your state of health. To help you, we would like you to imagine a scale (rather like a thermometer) on which the best state you can imagine is marked by 100 and the worse state you can imagine is marked by 0.

Think about how your health affects:

- Your general well-being
- Your independence and ability to take care of yourself
- Your ability to take care of others
- How you feel about yourself
- Your ability to get around and communicate
- Your ability to socialize
- Your performance at work

Your state of health today with your BAHA

We would like you to choose a point on the scale that indicates how good or bad you consider your state of health is today with your BAHA

Worst _____ Best

Your state of health before you received your BAHA

Worst _____ Best

Appendix 4

Interesting responses

- *I cannot tell you how this BAHA has changed my life. I wish we had this device years ago, as I have had to rely on lip reading all my life.*

- *Since the BAHA, I have got more into social activities to make up for all the years I missed out.*

- **Q: Since your BAHA, are you 'more' or 'less' optimistic about the future?**
- *A: I have always been optimistic about the future and cannot see the relevance of this question.*
- **Q: Since the BAHA, are you 'more' or 'less' embarrassed when with a group of people?**
- *A: I have never felt embarrassed about wearing any kind of hearing aid. I find this question upsetting.*
- **Q: Since the BAHA, are there 'more' or 'fewer' people who really care about you?**
- *A: My hearing aid makes no difference. My friends and family have always cared for me. I find this question very upsetting.*

- *My daughter and I filled in these forms together; some of the questions were rather difficult for a 9-year-old to answer. However, the details in the questions did actually focus her mind on how well (or not) she hears in some situations.*

- *I am very happy and grateful to you for the BAHA and so is my husband. I must have been a miserable person to live with before the BAHA.*

- **Q: Your state of health before you received your BAHA and today with your BAHA.**
- *A: I was not mentally retarded before the BAHA. Somehow there is such an implications in this question.*