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Do patients report quality of life improvements after fitting of their unilateral bone conducting hearing implant?

S Meghji[1], A Collett[2], I Nunney[3], P Prinsley[1] and J Hanif[1]

[1]Departments of Otolaryngology, [2]Audiology, Norfolk and Norwich University Hospital, Norwich, UK and [3]Norwich Clinical Trials Unit, Norwich Medical School, University of East Anglia, Norwich, UK

Main Article

Miss S Meghji takes responsibility for the integrity of the content of the paper

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Author for correspondence:
Miss Sheneen Meghji,
Department of Otolaryngology,
Norfolk and Norwich University Hospital,
Colney Lane, Norwich NR4 7UY, UK
E-mail: Sheneen_m@hotmail.com

Abstract

Objective. The audiological benefits of a bone conducting hearing implant are well documented; however, there is a paucity of literature comparing pre- and post-operative quality of life benefits. This study assessed the quality of life status before and after the device is implanted.
Methods. A prospective study was conducted of all adult bone conducting hearing implants inserted in a teaching hospital between 2012 and 2017. All patients completed the Glasgow Health Status Inventory, a validated quality of life questionnaire, before and three to six months after implantation.
Results. Sixty-two patients received a unilateral bone conducting hearing implant. All scores except the social score improved post-operatively. The paired *t*-test showed that the differences in the means for the Glasgow Health Status Inventory total, general and physical scores were statistically significant at the 5 per cent level ($p < 0.0001$).
Conclusion. This study, one of the few to assess quality of life pre- and post-implantation, showed a vast improvement in patients' perceived quality of life from the pre- to the post-operative phase.

Introduction

Changes in a patient's quality of life (QoL) must be considered when assessing the overall success of a surgical intervention. Patient-reported outcome measures are widely used in surgery to determine the qualitative impact of a particular intervention or device.

The Glasgow Benefit Inventory is a validated questionnaire used fairly frequently in otolaryngology patients when investigating generic patient-reported outcome measures.[1,2] It was initially designed to be used post-intervention to assess the impact of a procedure. The Glasgow Health Status Inventory is similar to the Glasgow Benefit Inventory questionnaire, and measures the effect of a health problem on an individual's QoL. It can be used for cross comparison of health conditions with different interventions, and can be employed at any point during the patient's timeline.

In 1977, Tjellström *et al.*[3] were the first clinicians to insert a bone conducting hearing implant. Now, more than 40 years later, more than 150 000 individuals have achieved auditory rehabilitation with a bone conducting hearing implant. The success of implantation with a bone-anchored hearing device depends on appropriate patient selection, minimal localised skin complications and good osseointegration of the titanium implant.[4]

The audiological and QoL benefits of bone conducting hearing devices have been well documented in many previous studies.[2,5–12] Over the last 40 years, there has been considerable modification of the device size and implant type.[4,13–15] There has also been a move towards less invasive soft tissue techniques and use of the minimally invasive Ponto surgery technique.[16–23] Many of the previous QoL studies were performed with older devices and using more invasive soft tissue surgical techniques.[24]

Whilst it is clear that bone conducting hearing implants demonstrate a qualitative benefit, there remains a paucity of literature comparing pre- and post-operative QoL benefits. This study assessed the QoL status before and after the bone conducting hearing device is implanted.

Materials and methods

A prospective, cross-sectional study was conducted of all consecutive adult patients who underwent bone conducting hearing implant insertion in a large teaching hospital in the east of England over a period of five years. Eighty-eight patients were approved and scheduled to receive a bone conducting hearing implant between March 2012 and March 2017.

The Glasgow Health Status Inventory questionnaire contains 18 questions, which relate to 4 domains: general, psychological, social and physical wellbeing. Responses are scaled and averaged using a five-point Likert scale. The poorest outcome score is

−100 and the best outcome score is +100. The Glasgow Health Status Inventory questionnaire was completed by the patient and the specialist audiologist pre- and post- implantation. The patients' clinical and audiological notes were reviewed to assess audiological outcomes and check for any complications regarding the surgery.

Regarding the inclusion criteria of the study, patients were aged 18 years or older, receiving a unilateral bone conducting hearing implant, and able to communicate effectively in order to complete the pre- and post-operative questionnaires. Patients were excluded if they were receiving a second implant, or had not completed any pre- or post-operative questionnaires at the time of the study.

Results

Eighty-eight patients were approved for implantation of a bone conducting hearing device; these were inserted between March 2012 and March 2017. Twenty-six patients were excluded from analysis; 11 patients were having a second bone conducting hearing implant placed, 11 patients did not have pre-operative scores noted or were not contactable, 3 abutments fell out and 1 minimal access procedure failed.

Sixty-two patients had a unilateral bone conducting hearing implant placed and completed both questionnaires. The patients consisted of 27 females and 35 males, with a median age of 65 years (range of 27–87 years).

All 62 patients underwent a single-stage surgical procedure using a soft tissue preservation approach. Fifty-six patients had a linear incision with a punch, and six patients had the new minimally invasive Ponto surgery technique. Of the four failed procedures, one had the minimally invasive Ponto surgery technique. Implants were placed on the right side in 33 patients and on the left side in 29 patients. All patients received a percutaneous implant with an abutment. All operations were performed in the operating theatre under general or local anaesthesia by two ENT consultants.

Reasons for implantation included: recurrent infections, mastoid cavities, behind the ear hearing aids not loud enough, microtia and others (e.g. single-sided deafness, otosclerosis and canal stenosis) (Figure 1).

Glasgow Health Status Inventory questionnaires were completed pre-operatively and 3–12 months post-implantation. One patient did not attend formal follow up, and two others did not have post-operative questionnaire scores recorded. Three telephone follow-up sessions were conducted, and questionnaires were completed for these patients.

Analysis of the Glasgow Health Status Inventory questionnaire data revealed that the average total score increased from −24 pre-operatively to +53 post-operatively. The general benefit score increased from −35 to +69. The physical score increased from −29 to +26. The social score decreased from +44 to +13. A box plot of the pre- and post-operative scores can be seen in Figure 2.

Paired *t*-tests were used to calculate the difference between the pre- and post-implantation Glasgow Health Status Inventory scores. The differences in the means for the total, general and physical scores were statistically significant at the 5 per cent level ($p < 0.0001$). There was no statistically significant difference between the pre- and post-implant scores in the social support domain ($p = 0.70254$). Statistical analyses were performed using SAS software, version 9.4 (SAS Institute, Cary, North Carolina, USA).

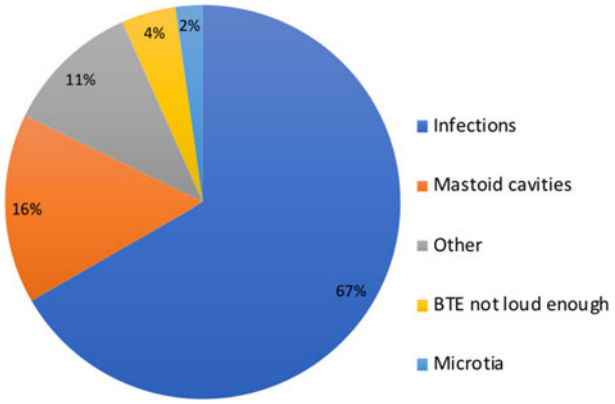

Fig. 1. Reasons for the unilateral bone conducting hearing implant. BTE = behind the ear hearing aid

Discussion

The current study is noteworthy, as it confirms the improvements seen in patients' QoL after implantation of a bone conducting hearing device.[14,25–27] It is one of the few prospective studies to show a change in QoL from pre- to post-implantation. Furthermore, it introduces the novel use of the Glasgow Health Status Inventory questionnaire, which is fast and easy to implement before and after an intervention to attain a matched comparison.

- Bone conducting hearing implants are an alternative for patients who may not benefit from air conducting hearing aids
- The Glasgow Health Status Inventory is a validated quality of life (QoL) indicator that is fast and easy to implement, and can be used to get a matched comparison
- A significant improvement was seen in Glasgow Health Status Inventory questionnaire average total, general benefit and physical scores
- There was no post-operative improvement in QoL social score, likely a result of minimal change in patients' social support networks
- Innovative advances in devices and surgery, and a dedicated multidisciplinary team approach, has streamlined the patient's pathway and increased QoL

The study highlights a vast improvement in patients' perceived QoL after bone conducting hearing implant surgery. The post-operative Glasgow Health Status Inventory total and general scores showed a statistically significant improvement when compared with the pre-operative scores. The physical score also improved post-operatively. Patients felt that they were healthier, as they were not attending their general practitioner as frequently, and that they had experienced fewer colds or infections since the fitting of the device. A few of the questionnaires included personal comments from patients who reported decreased visits to their otolaryngology clinic for microsuction and treatment of recurrent infections associated with continued use of conventional air conducting hearing aids. These improvements have been noted in other studies.[25–27]

The improvements noted in this study are the result of vast progression technologically and the use of a patient-centred approach to implantation. Innovative advances have led to the devices becoming smaller and more powerful. Newer surgical techniques, with a reduction in soft tissue trauma, have improved the efficiency and speed of surgery, and permit the procedure to be performed under local anaesthesia. Patients with complex medical co-morbidities can now benefit from a bone conducting hearing implant; patients have faster recovery and can undergo implantation as a day-stay surgical procedure, thereby also reducing the burden of hospital bed

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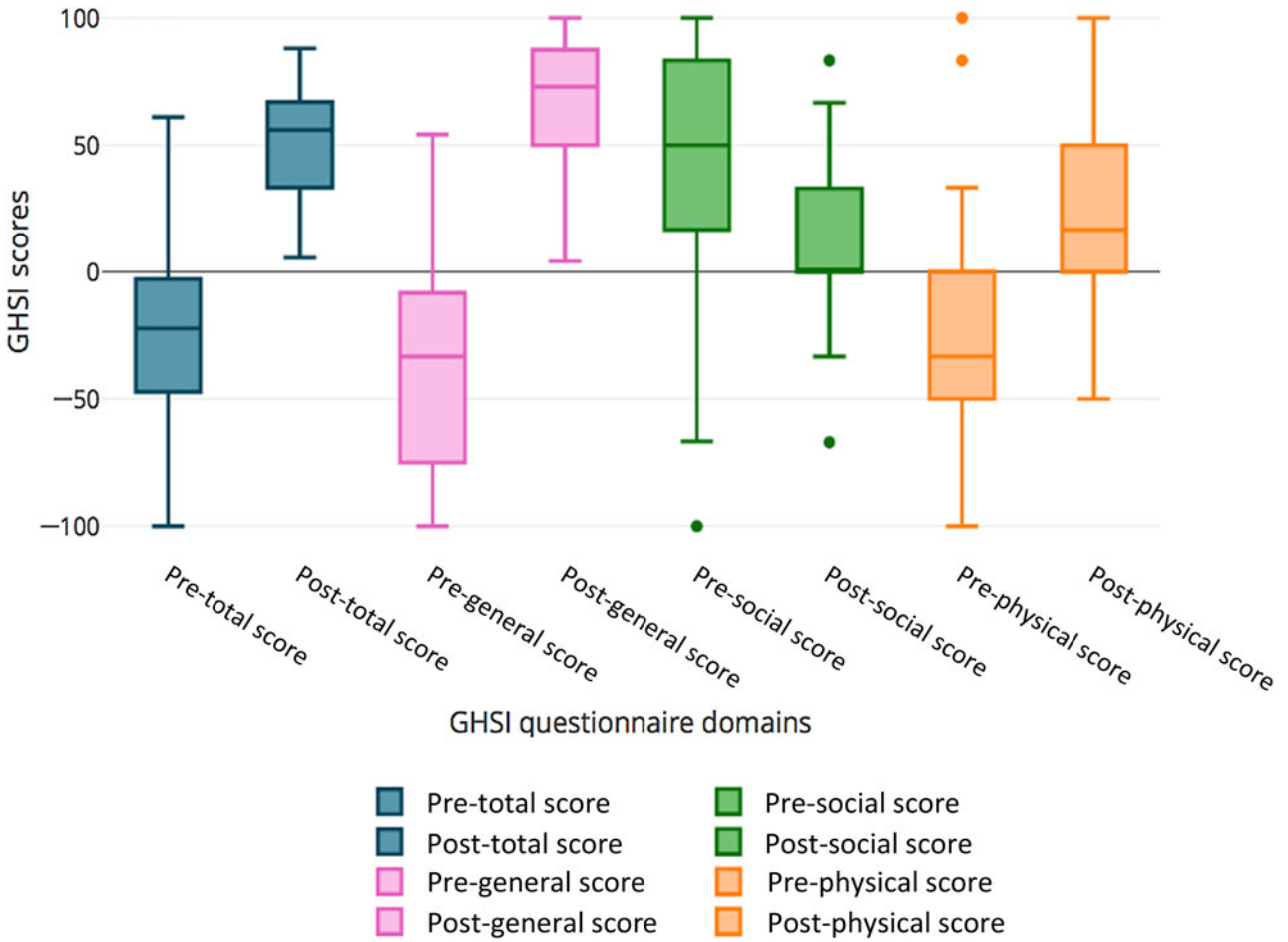

Fig. 2. Pre- and post-implant scores on the Glasgow Health Status Inventory (GHSI) questionnaire.

shortages. Additionally, the use of a multidisciplinary team approach and staff dedicated to bone conducting hearing implant patients has streamlined the patient's pathway and continuity of care. These improvements have all led to increased patient satisfaction concerning both the short-term procedure and the long-term hearing outcomes.

The study does have its limitations. It was a relatively small-scale study involving 62 patients. It did not include patients in whom bone conducting hearing implant placement had failed. The post-operative questionnaire requires the device to be loaded onto the implant; therefore, the study was prone to selection bias. The Glasgow Health Status Inventory pre- and post-intervention comparison can result in a misleading interpretation of the raw score. In our cohort, patients reported very good social support prior to the intervention, scoring +44 on the social scale. Post-operatively, patients did not report any changes to their social support, therefore scoring +13 on the social scale. The decline in score may lead to the misinterpretation that the procedure had a negative impact on a patient's social QoL.

Clinical application

It is estimated that approximately ten million people in the UK have a degree of hearing impairment.[28] Initial rehabilitation of hearing loss is typically attempted with conventional air conducting hearing aids. When conventional hearing aids are not suitable or do not provide adequate benefit for the patient, then bone conducting hearing devices may be considered. The clinical commissioning policy from NHS England has concluded that there is evidence to suggest that bone conducting hearing implants are beneficial. In order to continue funding unilateral and even bilateral bone conducting hearing devices, it remains crucial to have a wealth of evidence for the audiological and QoL benefits that these hearing aids provide.[29]

Conclusion

This study adds to the body of evidence suggesting that patients fitted with a unilateral bone conducting hearing implant report immense QoL improvements in nearly all domains of their life.

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Competing interests. None declared

References

1 Robinson K, Gatehouse S, Browning GG. Measuring patient benefit from otorhinolaryngological surgery and therapy. *Ann Otol Rhinol Laryngol* 1996;**105**:415–22

2 Hendry J, Chin A, Swan IRC, Akeroyd MA, Browning GG. The Glasgow Benefit Inventory: a systematic review of the use and value of an otorhinolaryngological generic patient-recorded outcome measure. *Clin Otolaryngol* 2016;**41**:259–75

3 Tjellström A, Rosenhall U, Lindstrom J, Hallen O, Albrektsson T, Branemark I. Five-year experience with skin-penetrating bone-anchored implants in the temporal bone. *Acta Otolaryngol* 1983;**95**:568–75

https://doi.org/10.1017/S0022215121000074 Published online by Cambridge University Press

4 Kruyt IV, Banga R, Banerjee A, Mylanus EAM, Hol MKS. Clinical evaluation of a new laser-ablated titanium implant for bone-anchored hearing in 34 patients: 1-year experience. *Clin Otolaryngol* 2018;**43**:761–4
5 Dutt SN, McDermott AL, Jelbert A, Reid AP, Proops DW. The Glasgow benefit inventory in the evaluation of patient satisfaction with the bone-anchored hearing aid: quality of life issues. *J Laryngol Otol* 2002;**116**:7–14
6 de Wolf MJF, Shival MC, Hol MKS, Mylanus EAM, Cremers CWRJ, Snik AFM. Benefit and quality of life in older bone-anchored hearing aid users. *Otol Neurotol* 2010;**31**:766–72
7 Gillett D, Fairley J, Chandrashaker T, Bean A, Gonzalez J. Bone-anchored hearing aids: results of the first eight years of a programme in a district general hospital, assessed by the Glasgow benefit inventory. *J Laryngol Otol* 2006;**120**:537–42
8 McLarnon CM, Davison T, Johnson IJ. Bone-anchored hearing aid: comparison of benefit by patient subgroups. *Laryngoscope* 2004;**114**:942–4
9 McDermott AL, Dutt SN, Tziambazis E, Reid AP, Proops DW. Disability, handicap and benefit analysis with the bone-anchored hearing aid: the Glasgow hearing aid benefit and difference profiles. *J Laryngol Otol Suppl* 2002;**28**:29–36
10 Badran K, Bunstone D, Arya AK, Suryanarayanan R, Mackinnon N. Patient satisfaction with the bone-anchored hearing aid: a 14-year experience. *Otol Neurotol* 2006;**27**:659–66
11 Swan IR, Guy FH, Akeroyd MA. Health-related quality of life before and after management in adults referred to otolaryngology: a prospective national study. *Clin Otolaryngol* 2012;**37**:35–43
12 Mace AT, Isa A, Cooke LD. Patient quality of life with bone-anchored hearing aid: 10-year experience in Glasgow, Scotland. *J Laryngol Otol* 2009;**123**:964–8
13 Wilkie M, Chakravarthy K, Mamais C, Temple RH. Osseointegrated hearing implant surgery using a novel hydroxyapatite-coated concave abutment design. *Otolaryngol Head Neck Surg* 2014;**151**:1014–19
14 Arunachalam PS, Kilby D, Meikle D, Davison T, Johnson IJ. Bone-anchored hearing aid: quality of life assessed by Glasgow benefit inventory. *Laryngoscope* 2001;**111**:1260–3
15 Allis TJ, Owen DB, Chen BJ, Dwight T, Moore GF. Longer length Baha™ abutments decrease wound complications and revision surgery. *Laryngoscope* 2014;**124**:989–92
16 Calon TG, van Hoof M, van den Berge H, de Bruijn AJ, van Tongeren J, Hof JR *et al*. Minimally invasive Ponto surgery compared to the linear incision technique without soft tissue reduction for bone conduction hearing implants: study protocol for a randomized controlled trial. *Trials* 2016;**17**:540
17 Husseman J, Szudek J, Monksfield P, Power D, O'Leary S, Briggs R. Simplified bone-anchored hearing aid insertion using a linear incision without soft tissue reduction. *J Laryngol Otol* 2013;**127**:S33–8
18 Roplekar R, Lim A, Hussain SS. Has the use of the linear incision reduced skin complications in bone-anchored hearing aid implantation? *J Laryngol Otol* 2016;**130**:541–4
19 Van der Stee EHH, Strijbos RM, Bom SJH, Hol MKS. Percutaneous bone-anchored hearing implant surgery: linear incision technique with tissue preservation versus linear incision technique with tissue reduction. *Eur Arch Otorhinolaryngol* 2018;**275**:1737–47
20 Alshehri H, Alsanosi A, Majdalawieh O. Modified Baha punch technique: least invasive, shortest time and no suturing. *Indian J Otolaryngol Head Neck Surg* 2016;**68**:80–6
21 Van de Berg R, Stokroos RJ, Hof JR, Chenault MN. Bone-anchored hearing aid: a comparison of surgical techniques. *Otol Neurotol* 2010;**31**:129–35
22 Gordon SA, Coelho DH. Minimally invasive surgery for osseointegrated auditory implants: a comparison of linear versus punch techniques. *Otolaryngol Head Neck Surg* 2015;**152**:1089–93
23 Mohamad S, Khan I, Hey SY, Musheer HSS. A systematic review on skin complications of bone-anchored hearing aids in relation to surgical techniques. *Eur Arch Otorhinolaryngol* 2016;**273**:559–65
24 Snyder MC, Moore GF, Johnson PJ. The use of full-thickness skin grafts for the skin-abutment interface around bone-anchored hearing aids. *Otol Neurotol* 2003;**24**:255–8
25 Mylanus EA, Snik AF, Cremers CW. Patients' opinions of bone-anchored vs conventional hearing aids. *Arch Otolaryngol Head Neck Surg* 1995;**121**:421–5
26 Tjellström A, Granström G. One-stage procedure to establish osseointegration: a zero to five years follow-up report. *J Laryngol Otol* 1995;**109**:593–8
27 Macnamara M, Phillips D, Proops DW. The bone anchored hearing aid (BAHA) in chronic suppurative otitis media (CSOM). *J Laryngol Otol Suppl* 1996;**21**:38–40
28 NHS England. Clinical Commissioning Policy: Bone conducting hearing implants (BCHIs) for hearing loss (all ages). In: https://www.england.nhs.uk/commissioning/wp-content/uploads/sites/12/2013/05/16041_FINAL.pdf [22 December 2020]
29 Ho EC, Monksfield P, Egan E, Reid A, Proops D. Bilateral bone-anchored hearing aid: impact on quality of life measured with the Glasgow Benefit Inventory. *Otol Neurotol* 2009;**30**:891–6

https://doi.org/10.1017/S0022215121000074 Published online by Cambridge University Press