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# ANALYSIS OF END-USER PERCEIVED BENEFIT WITH THE BONE-ANCHORED COCHLEAR STIMULATOR (BAHA) USING THE ABBREVIATED PROFILE OF HEARING AID BENEFIT (APHAB) IN A CLINICAL SETTING

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## BONE-ANCHORED COCHLEAR STIMULATION

Bone-anchored cochlear stimulation (BAHA) has been available in the United States of America since FDA approval in 1996, for use in conductive and mixed hearing losses due to conditions such as unilateral or bilateral chronic otitis media or aural atresia, and in 1999 for pediatric patients older than age five years. Since 2002, BAHA has been approved for unilateral sensorineural hearing loss, called single sided deafness, resulting from disease, surgery or congenital causes. Conventional air-conduction hearing aids were often inappropriate, as in the presence of single sided deafness, or resulted in infection for patients with chronic draining ears. Occluding an ear with chronic drainage, or attempting to amplify a person with a large mastoid cavity often resulted in discomfort or infection. Bone-conduction hearing aids were uncomfortable and unattractive. Contralateral Routing of Offside Signal (CROS) aids have not been widely accepted by people with unilateral sensorineural hearing loss.

## INTRODUCTION

BAHA provides an effective, easy-to-use, cosmetically acceptable alternative for this population that otherwise is not well served. However, as practitioners, audiologists and others need a convenient instrument to measure patient benefit from BAHA. Patient benefit from BAHA has been measured using a variety of questionnaires, including one developed by Entific Medical Systems, Abbreviated Profile of Hearing Aid Benefit (APHAB), described in 1995,<sup>(1)</sup> Glasgow Hearing Aid Benefit Profile (GHABP) described in 1997,<sup>(2)</sup> and surveys developed by individual clinical practices. Clinical studies also have evaluated patients according to type of hearing loss such as conductive, mixed or sensorineural single-sided deafness being treated by BAHA.

Hakasson et al., surveyed a group of 127 adults at a variety of sites who were using BAHA HC200/HC300 (Classic) sound processor. A satisfaction questionnaire was completed which asked about hours worn per day, and survey results showed improved speech intelligibility, better sound comfort, decreased skin irritation and skin pressure, increased ease of handling and cosmetic acceptance, and decreased incidence of ear infection.<sup>(3)</sup> In 2001, Arunachalam et al., studied 60 adults with conductive and mixed hearing losses. The subjects were questioned regarding quality of life issues with Glasgow Benefit Inventory and found significant improvement<sup>(4)</sup>. In 2002, Dutt, et al., analyzed results from two hundred twenty-seven patients who completed the Glasgow benefit inventory survey. Their findings were consistent with previous studies, showing enhanced quality of life and increased patient satisfaction from the use of the BAHA.<sup>(5)</sup> Another group of 10 adults with single-sided deafness were fitted with CROS amplification followed by surgical implantation and hookup with BAHA. They were surveyed with both APHAB and GHABP with similar results.<sup>(6)</sup>

The BAHA Implant Program at Loyola University Medical Center in Maywood, Illinois, began in October 2004, and had an implant group of 105 ranging from 2 years to 81 years of age. Approximately two-thirds of our implant population was single side deafened resulting from acoustic neuroma, and sudden sensorineural hearing loss; and one-third was conductive or mixed hearing loss, from aural atresia, cholesteatoma, and chronic otitis media. Sam J. Marzo, MD, performed the implantation procedure during outpatient surgery.

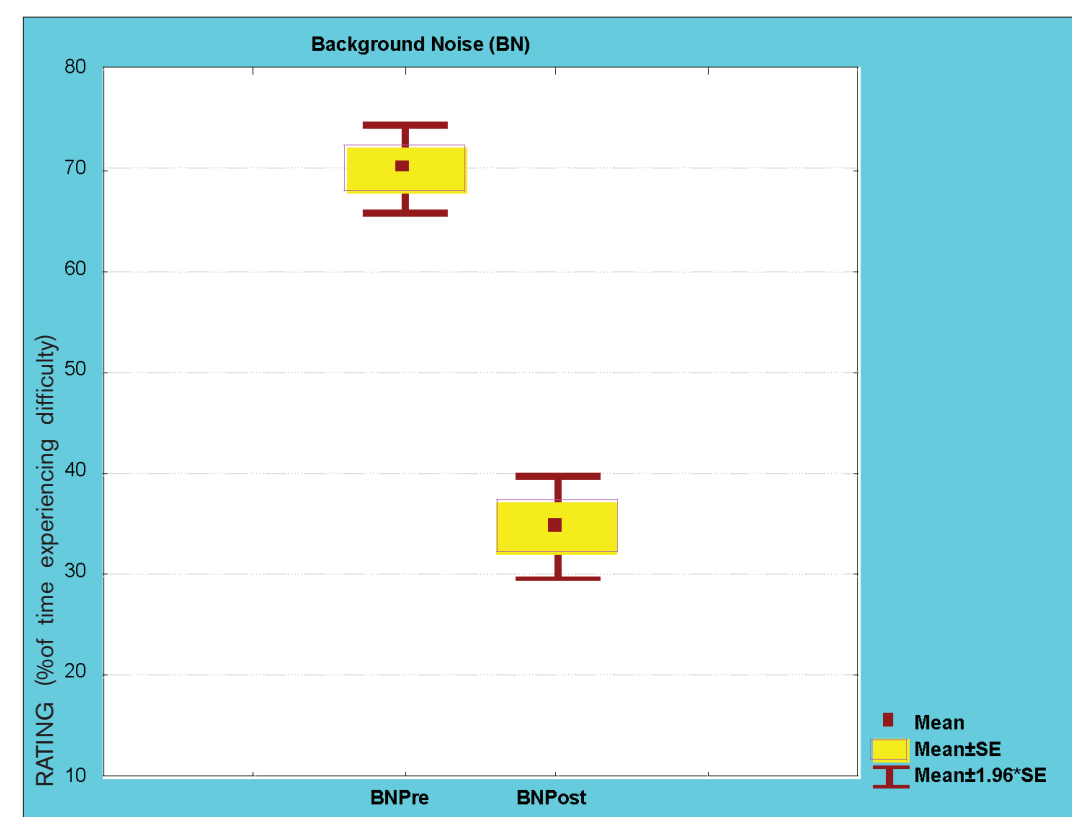
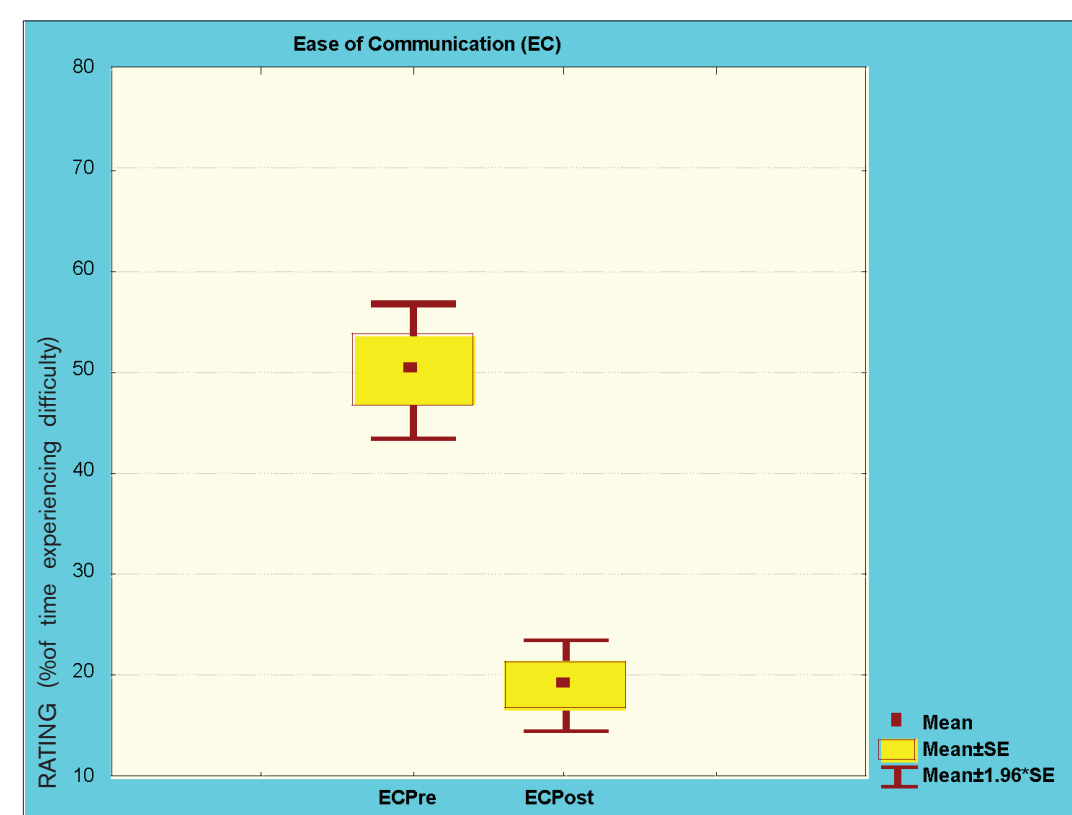
## METHOD

The protocol for BAHA included audiological evaluation with air- and bone-threshold measures, speech reception thresholds and speech discrimination in quiet. The patient's previous history of amplification was taken into consideration. A trial with a BAHA sound processor mounted on a metal headband was performed and if requested, the patient wore the headband-mounted BAHA at home for one week. The BAHA external sound processor was activated approximately three months post operatively. At the time of the activation appointment (pre) and four to eight weeks after activation (post), the Abbreviated Profile of Hearing Aid Benefit (APHAB) was administered. Our goal was to measure patient benefit in a variety of listening environments.

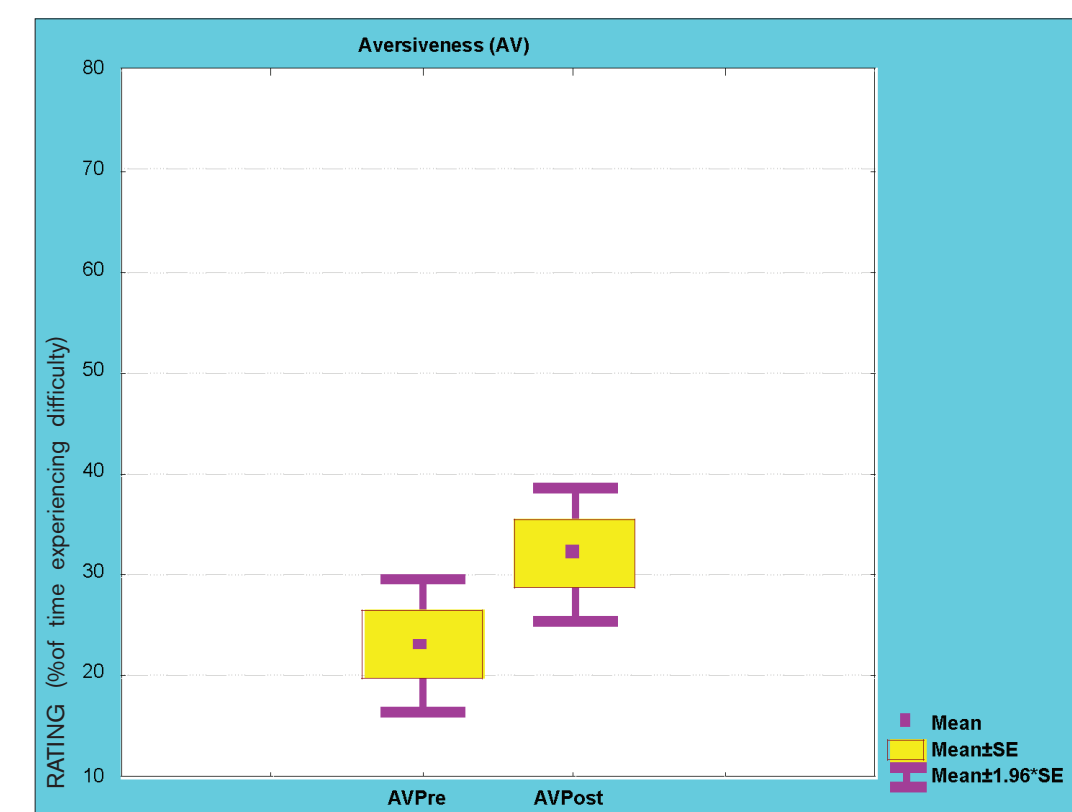
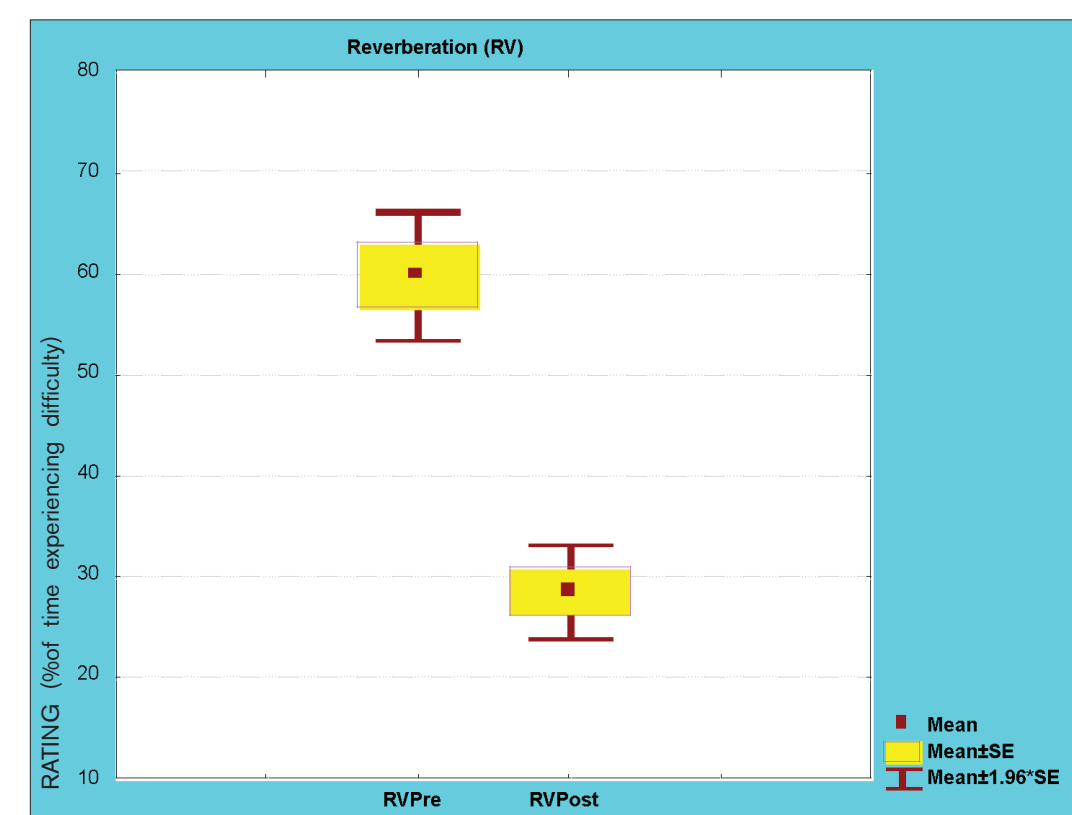
APHAB is a recognized self-assessment inventory that is easy to administer and analyze, and is well-respected by audiologists. This scale evaluated subjects according to the communication difficulty reported in unaided versus aided conditions. Our study examined hearing difficulty reported prior to BAHA external sound processor activation (pre) and after activation (post). Four different subscales were scored: Ease of Communication (EC); ReVerberation (RV), Background Noise (BN), and AVersiveness (AV). Each category contained eight questions with a forced choice between seven items on a scale ranging from "Always" (99%) to "Never" (1%).

Fifty-one subjects ranging from 10 years to 81 years of age completed the APHAB. All subjects were current BAHA users who were implanted through the Loyola University Medical Center BAHA Implant Program. This population was divided between 25 males and 26 females. All patients were considered without respect to type of BAHA sound processor at initial activation. Thirty-one subjects wore Compact, one wore Classic, and one wore Cordelle II. Significant benefit was reported in the aided condition compared to the unaided condition.

## ANALYSES



## ANALYSES (CONTINUED)



## RESULTS

Pre-Post fitting data were analyzed for the 51 subjects using multiple dependent t-tests. Ease of Communication improved by 31% ( $p < 0.0000$ ), deleterious effects of Background Noise were reduced by 35% ( $p < 0.0000$ ), difficulties in ReVerberation were reduced by 31% ( $p < 0.0000$ ). AVersiveness, however, increased by 8.95% which was not significant at the overall adjusted 0.05 level of confidence (4 t-tests being assessed, each had to be significant at the 0.0125 level of confidence for the overall assessment to be significant at the 0.05 level of confidence).

## DISCUSSION AND CONCLUSION

Questions regarding quality of life after implantation and activation of the BAHA are of great importance. Patients want to be assured that surgery will benefit them. Insurance carriers must ascertain benefit from any surgical procedure. Audiologists need accurate information to appropriately counsel patients regarding their amplification options. APHAB is an instrument that demonstrates degree of benefit in a variety of listening environments, and provides opportunity to counsel patients about appropriate expectations.

Our data suggest that patients benefit from BAHA usage under a variety of listening conditions (EC). BAHA reduces the annoyance of unwanted sounds (BN, RV). However, BAHA does worsen the reaction to loud and unexpected sounds (AV). Based on these data, perhaps further research in strategies for output limiting might improve BAHA performance further.

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