Critical Review:

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This critical review examined the subjective and objective benefits associated with the BAHA hearing system in adults with unilateral deafness. Study designs included: survey research and case series (1), meta-analysis (1), cross-sectional cohort design (1), prospective within group (repeated measures) design (2), prospective mixed between and within groups (repeated measures) design (1), case series pre-post test design (1). The current research reviewed did not provide sufficient support for recommending the BAHA hearing system to all adults with unilateral deafness. Some positive subjective and objective results have been demonstrated, but these results should be taken with caution. Additional studies investigating this treatment should investigate the impact of microphone directionality and the characteristics of successful BAHA users in this population.

Introduction

Unilateral deafness can result in difficulty understanding speech in noise, poor localization ability, loss of binaural summation and integration and difficulty hearing sounds from the deaf side (Newman, Sandridge and Wodzisz, 2008).

The conventional treatment for this condition is a Contralateral Routing of Signal CROS system. A CROS aid transfers sound from a microphone placed the deaf side to a hearing aid positioned on the ear with normal hearing thresholds connected by either a cable or wireless technology (Dillon, 2001). Several studies have suggested limited success with CROS system

used. To avoid redundancy, studies with the same subjects used in another, similar study, were omitted.

Data Collection

Results of the literature search yielded seven studies: survey research and case series (1), meta-analysis (1), cross-sectional cohort design (1), prospective within group (repeated measures) design (2), prospective mixed between and within groups (repeated measures) design (1), case series pre-post test design (1).

Results

Survey Research and Case Series:

Andersen, Schroder, and Bonding (2006) approached fifty-nine patients with unilateral deafness as a result of removal of an acoustic neuroma to complete a short subjective questionnaire that investigated handicap associated with unilateral deafness using a visual analogue scale. Fifty-three patients responded and were invited to try a BAHA device attached to a test band. Twenty-six of the patients participated in the BAHA trial. Speech discrimination in quiet and in noise was measured with the BAHA test band and in the unaided condition. After this testing patients walked around in various sound environments and were subsequently interviewed about their experience and satisfaction with the BAHA.

The initial questionnaire revealed high variability within the subject population. Of the fifty-three subjects, fifty-two thought they had a hearing handicap, 45% perceived it as being significant, 38% perceived that it was moderate and 15% thought it was a minor problem. Thirty-eight patients indicated that they were interested in trying the BAHA test band; this was correlated with their subjective hearing handicap. Twenty-six of the questionnaire respondents actually participated in the BAHA test band trial.

The speech in noise results showed significant improvement in the BAHA test-band condition compared to the unaided condition.

After wearing the BAHA test band for one hour the participants were interviewed about their experiences. Approximately 65% thought it was a satisfactory aid, 20/26 found it easier to hear sounds from the deaf side, 16/26 found it helpful for hearing speech in noise, 23/26 found the sound quality as being pleasant and natural. 5/6 existing conventional CROS users wanted treatment with the BAHA instead of their current CROS system. Approximately half the patients tried conventional CROS hearing aids but only a small number still used the aid and none of the patients found the system to be satisfactory.

Only 54% of the 26 decided they wanted to proceed with an implanted BAHA device, There was a trend to correlation between patients interested in the BAHA treatment and a high handicap score on the visual analogue scale but the correlation was not significant.

Statistical analysis to determine significance was not completed. Characteristics that defined individuals who decided to proceed with the BAHA surgery were not investigated although it was reported that the most frequent reason for not getting a BAHA device was that the benefit was too small. The researchers also suggested that the patients may have been hesitant about undergoing another surgery.

Cross-sectional Cohort Design:

Dumper, Hodgetts, Liu, and Brandner (2009) evaluated fifty patients who currently wear BAHA hearing systems. The patients were divided into four categories of hearing loss: bilateral conductive hearing loss, unilateral conductive hearing loss, unilateral mixed hearing loss, and unilateral deafness. The unilateral deafness group consisted of fifteen participants. The HINT was administered in the aided and unaided condition for all subjects in a variety of speaker configurations. The APHAB and SSQ were also administered to all subjects. The SSQ was used to make a comparison across the test groups and is therefore not relevant to the present analysis.

A 2x4x4 mixed ANOVA was run on the HINT data. The results revealed no significant improvement in the unilateral deafness test group.

The APHAB is able to provide a comparison of results between the unaided and aided with the BAHA. A 4x4 mixed ANOVA showed significant subjective improvement in patients with unilateral deafness in the BAHA-aided condition. These results were similar to the other test groups.

Although there is little objective improvement for the unilateral deafness test group, Dumper, et al. (2009) suggest that the objective tests used may not be sensitive enough to detect the benefit shown in the subjective results, that is the test may not be representative of real world listening conditions. The researchers believe it is unlikely related to the placebo effect because this test group regularly uses their devices and improvements have been reported years after their initial surgery.

the BAHA-aided condition. The SSDQ showed a positive BAHA impact on each item and time had no statistically significant influence on the scores.

Discussion

Overall, these studies were well designed and used reasonable outcome measures, however statistical analysis was lacking in several of the studies. The speech in noise test results varied across studies and are difficult to compare because the location of the speech and noise signal also varied substantially.

It appears as though the BAHA provides benefit understanding speech in noise in a common real-world listening environment where the speech is presented from the front in the presences of diffuse noise (Andersen, et al., 2006 & Newman et al., 2008).

Yuen et al. (2009) and Newman, et al. (2008) found speech in noise scores showed a significant BAHA benefit when noise was presented to the participants' normal hearing ear and speech was presented to the BAHA aided side. Linstrom, et al. (2009) also showed a BAHA benefit when speech was presented to the BAHA aided side and noise was presented from the front.

Yuen, et al. (2009) did not perform the HINT in the condition with noise presented to the BAHA side and speech to the normal hearing ear because they stated the individual could down or turn off the device in this challenging listening condition.

When speech was presented from the front and noise presented to the BAHA side the SNR mean was significantly worse (Newman, et al., 2008 & Linstrom, et al., 2009). Dumper, et al. (2009) found similar results for this configuration, although they were not statistically significant.