Mild-Gain Hearing Aids as Treatment for Adults with Subjective Hearing Difficulties

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Abstract

The effectiveness of a trial with mild-gain amplification for adults with subjective hearing difficulties (HD) and normal hearing sensitivity was investigated. HD were assessed using questionnaires and an auditory processing test battery. Results demonstrated significant differences in self-perceived auditory abilities between HD subjects and controls. HD subjects performed significantly poorer on the Revised Speech Perception in Noise test relative to controls, especially on the low predictability items. Results of the hearing aid trial with HD subjects will be discussed.

Introduction

• There is a growing body of evidence demonstrating subjective hearing difficulties (HD) [1] (i.e., substantial difficulty understanding speech in complex listening situations) in adults with normal pure tone sensitivity.
• Adults may present with normal pure tone sensitivity on the audiogram, yet have suprathereshold complaints and performance deficits.
• Anecdotally, some audiologists have tried personal mild-gain amplification as a treatment option for adults with HD. Kuk et al. (2008) reported positive results of a mild-gain hearing aid trial for children with auditory processing disorders. To date, however, there have been no studies investigating the benefit of mild-gain amplification to treat HD in adults with normal audiograms.
• The purpose of the present study was to investigate the effectiveness of a 4-week trial with mild-gain amplification for adults with subjective HD and confirmed auditory processing deficits in the presence of normal pure tone sensitivity.

Methods

Subjects
• Control Group: 20 adults 19-27 years of age (mean = 21.8 years) without subjective HD
• Experimental Group: 17 adults 18-58 years of age (mean = 30.8 years) with subjective HD
• All subjects had normal hearing with pure tone thresholds ≤ 25 dB HL

• One subject had a 20 dB HL threshold at one frequency

Materials

• Questionnaires:
  • Hearing Handicap Inventory for Adults (HHIA) [2]
  • Used to classify subjects as having HD score of ≥ 20
  • Auditory processing Questionnaire (APQ)
  • Revised version of the Children’s Auditory Processing Performance Scale [3, 4]
  • Used to assess self-perceived auditory processing abilities
  • Auditory Processing Test Battery (HD subsets only)
  • SCAN 2.5 [5]; Gains-In-Noise test (GIN) [6]; 500-Hz Masking Level Difference test (MLD) [7]; Dichotic Digit Test [2001] [8]

• Speech-in-Noise
  • Revised Speech Perception in Noise test (RP-SIN) [9] at -2, -4, and 0 dB signal-to-noise ratios (SNR)

Procedures
• Session 1: Determine candidate; complete questionnaires and auditory test battery; control subjects completed the speech-in-noise testing.
• Session 2: Unaided R-SIN testing; and hearing aid verification, fitting and orientation.
• Session 3: Aided R-SIN testing; complete aided questionnaires.

Hearing Aid Trial
• HD subjects were fitted binaurally with receiver-in-the-canal hearing aids (Widex Dream 440) with adaptive directional microphones and noise reduction enabled.
• Hearing gain: 5-10 dB of gain between 1000-4000 Hz for low to moderate inputs and 0-5 dB of gain for low input levels [10].
• HD subjects completed a four-week trial with a goal of wearing the hearing aids 4-hours/day (see Figure 1).

• Data were presented for 16/17 HD subjects that have completed the trial.

• Significant differences in HHIA and APQ responses, and R-PIN recognition performance between the Control and HD groups suggests that the HD group represents an unique population, despite ‘normal’ pure tone sensitivity.
• S/L HD subjects reported a diagnosed history of traumatic brain injury (TBI). Subjective HD and auditory processing deficits have been reported for individuals with TBI [11].
• Use of mild-gain hearing aids resulted in significant reductions in hearing handicap and self-reported auditory processing difficulties (see Figure 5), as well as significant improvements in speech-in-noise performance (see Figure 6).
• Results from the HA trial suggest that mild-gain hearing aids with directional microphones and noise reduction are viable treatment options for individuals with subjective HD.
• To date, two subjects have chosen to purchase hearing aids after completing the trial.

Results: Control vs. HD

Results: Hearing Aid Trial

• Figure 2. Mean HHIA and APQ scores for the Control (red bars) and HD groups (gray bars). Error bars represent one standard deviation (* indicates a significant difference, p < .05).

• Figure 3. Mean R-PIN recognition performance (in % correct) for the Control and HD groups as a function of SNR. Recognition performance for high predictability (HP) sentences are presented in the left panel (circles) and for low predictability (LP) sentences in the right panel (squares). Error bars represent one standard deviation. A repeated measures ANOVA revealed:
  • Significant poorer recognition performance for the HD group for HP than for LP sentences across all SNRs (p < .004).
  • Significantly better recognition performance at each successive SNR (-12 to 0 dB SNR) for HP and LP sentences and for both groups (p < .004).

• Figure 4. Real-ear output of the hearing aid to a 55, 65, and 80 dB SPL speech-shaped noise (DigiSpeech, Fonix 7000).

• Figure 5. Mean HHIA and APQ scores for the HD group in the unaided (green bars) and aided (gray bars) conditions. Error bars represent one standard deviation (* indicates a significant difference, p < .05).

• Figure 6. Mean R-PIN recognition performance (in % correct) for the HD group as a function of SNR and hearing aid condition: unaided (green) and aided (gray). Recognition performance for high predictability (HP) sentences are presented in the left panel (circles) and for low predictability (LP) sentences in the right panel (squares). Error bars represent one standard deviation. A repeated measures ANOVA revealed:
  • Significantly better recognition performance for HP than for LP sentences for all SNRs (p < .025).
  • Significantly better recognition performance in the aided condition for HP sentences at -12, 0, and 4 dB SNR, and for LP sentences at -12, -4, and 0 dB SNR (p < .006).
  • Significantly better recognition performance at each successive SNR for HP (except -4 vs. 0 dB SNR) and for LP sentences (p < .048).

Discussion

• Significant differences in HHIA and APQ responses, and R-PIN recognition performance between the Control and HD groups suggests that the HD group represents an unique population, despite ‘normal’ pure tone sensitivity.
• S/L HD subjects reported a diagnosed history of traumatic brain injury (TBI). Subjective HD and auditory processing deficits have been reported for individuals with TBI [11].
• Use of mild-gain hearing aids resulted in significant reductions in hearing handicap and self-reported auditory processing difficulties (see Figure 5), as well as significant improvements in speech-in-noise performance (see Figure 6).
• Results from the HA trial suggest that mild-gain hearing aids with directional microphones and noise reduction are viable treatment options for individuals with subjective HD.
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References


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