Cochlear implantation for single-sided deafness and severely asymmetric hearing loss: early outcomes for twelve patients from two centers

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Abstract

Unilateral profound sensorineural deafness, or single-sided deafness (SSD), has traditionally been a difficult disease to effectively treat due to several issues including: numerous and often idiopathic etiologies, variability in medical management, and a limited number of effective rehabilitation options. The most common cause of SSD is idiopathic sudden sensorineural hearing loss (ISSNHL) with an annual incidence of approximately 5-20 per 100,000. Several other causes of SSD include Meniere’s Disease, autoimmune inner ear disease, and acoustic neuroma to name a few. Regardless of cause, this cohort of patients lacks the ability to localize sound and has a significant impairment of hearing in noise making occupational, social, and everyday tasks difficult. Additionally, self-reported quality of life is negatively impacted in these patients.

Bone-anchored osseointegrated implants provide patients with improved sound awareness and hearing in some noise conditions. Sound localization ability is not restored to the affected ear; interaural phase, time, and level differences are not addressed, nor are the psychoacoustic properties of squelch or summation which require binaural hearing. Cochlear implantation provides patients with the higher-order auditory information necessary to utilize these central auditory processing phenomena.

The purpose of this study is to report on our early implantation and subjective outcomes following cochlear implantation for single-sided deafness in a small cohort of patients.

Background

Although cochlear implantation for asymmetric hearing loss and single-sided deafness is not FDA approved in the United States, our patients report a hearing loss and single sided deafness (SSD) due to any etiology and normal to near-normal hearing in the contralateral ear were included. No patient with AAO-HNS Class D hearing in the contralateral ear was included.

Selection Criteria

All adult patients with unilateral profound hearing loss (SSD) due to any etiology and normal to near-normal hearing in the contralateral ear were included. No patient with AAO-HNS Class D hearing in the contralateral ear was included.

Pre-Implant Demographics and Audiometric Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean, Median, or Frequency Count</th>
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<tbody>
<tr>
<td>Age (yrs)</td>
<td>Mean 52; Median 55; Range 9-74</td>
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<tr>
<td>Sex</td>
<td>6 male, 6 female</td>
</tr>
<tr>
<td>Laterality</td>
<td>7 left ears, 5 right ears</td>
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<tr>
<td>Follow-up (mo)</td>
<td>Mean 8.7; Median 7; Range 1-36</td>
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</tbody>
</table>

Post-implant Audiometric Data

Pre-implant AAO-HNS Hearing Class Non-implanted Ear

Contralateral Ear

Implied Ear

Word Recognition Scores (WRS%) Pre-implant

Follow-up CNC and Az-Bio scores by patient

Discussion

Currently, the accepted treatment options for SSD include contralateral routing of signal (CROS) hearing aids (i.e. SoundBite™), and bone-anchored osseointegrated implants. These treatments give patients improved sound awareness and variable improvements in hearing in noise, but unfortunately cannot replace the central auditory processing functionality afforded by two healthy cochleae. Of particular importance are the ability to provide sound localization and improved speech perception in noise. Owing to improvements in our understanding of the psychoacoustic properties that contribute to sound localization and speech perception in noise, cochlear implantation is now recognized as a definitive surgical treatment option for SSD. Data from Europe and Asia also show significant improvements in tinnitus perception and quality of life in those patients following implantation.

Hearing status in the contralateral, non-implanted ear will likely play a significant role in the outcome of patients implanted for SSD. Although the number of patients in this study is relatively small, it did appear that patients with fluctuating hearing in the contralateral ear due to Menière’s Disease or autoimmune hearing loss were not performing as well on post-implant testing compared to their normal hearing counterparts. However, the current study only reports early results of testing in the implant-only condition. Perhaps more longitudinal results, as well as testing in both the implant-only and binaural listening conditions, will show that all patients perform well regardless of etiology.

Conclusions

These data suggest that cochlear implantation for SSD is a viable treatment option regardless of etiology of deafness. When these patients were tested in the implant-only condition, all patients showed improvement in the post-implant ear, and the results are promising. Further long-term follow-up will be needed to help clarify the efficacy in binaural situations, as well as future implant candidacy.

References