Device Use and Decisional Regret in Single-Sided Deafness Patients with Cochlear Implants

Tirth R. Patel, MD[1]; Renee M. Banakis Hartl, MD, AuD[1]

[1]University of Michigan, Department of Otolaryngology-Head and Neck Surgery, Ann Arbor, MI, USA
Contact: patirth@med.umich.edu

ABSTRACT

- **Introduction:** Cochlear implantation is increasingly used for rehabilitation of single-sided deafness (SSD). Studies have shown that cochlear implants (CI)s improve speech perception in noise and sound localization for SSD patients. Although such benefits are uncovered in a research setting, the perceived benefit of CI for SSD patients in real-world environments can be variable. SSD patients with CI who do not perceive a benefit in daily life are at risk of becoming device non-users as they are not reliant on the CI for access to spoken language. In this study, we assess SSD patients' device use rates and the degree to which they regret their decision to obtain CI to identify patients who are at greatest risk of device non-use.
- **Methods:** A retrospective chart review is initially performed to identify SSD patients who received a CI at our institution. A control group consisting of unilaterally implanted patients with bilateral sensorineural hearing loss (SNHL) with also be identified. Demographic data, etiology of hearing loss, duration of hearing loss, pre-implantation audiometric results, post-implantation outcomes, and device use data logging results are extracted from the medical record. Next, a prospective telephone survey is conducted asking patients to quantify device use rates, perceived benefits of implantation, and regret in obtaining a CI using the validated Decision Regret Scale.
- **Results:** Results will be presented from statistical analysis determining the correlation between decisional regret and patient demographics, etiology of hearing loss, duration of hearing loss, pre-implant audiometry, post-implantation outcomes, device use rate, or self-perceived benefit from implantation. Outcomes will be compared between CI users from the two groups (SSD and unilaterally implanted bilateral SNHL).
- **Conclusion:** This study identifies SSD patients at greatest risk of CI device non-use and decisional regret in obtaining a CI. Results presented here will inform clinical practice regarding the potential need for establishing appropriate expectations, provide a foundation for additional preoperative counseling, and guide close follow-up to encourage device use and track progress. By critically analyzing these patients, we may be more able to optimally guide them through the rehabilitative process.

BACKGROUND

- Cochlear implants (CI) have been approved for treatment of single-sided deafness (SSD) in the United States since 2019.
- Research has shown CI improves speech perception in noise, sound localization, and tinnitus perception.
- Limited data shows that a small percentage of CI recipients with SSD become elective non-users, usually due to disappointment with sound quality.
- SSD patients are at higher risk of becoming non-users than traditional CI recipients because their functional hearing in one ear leads to limited disability.
- Understanding device use, patient perspectives on perceived benefit, and decisional regret with implantation can help guide candidacy for future SSD patients.

METHODS

- This study was approved by the University of Michigan Institutional Review Board.
- Retrospective review of CI recipients treated at our institution between 2010 and 2024 was performed.
- Two groups of patients were identified:
  - Bilateral hearing loss (BHL) with a single CI
  - SSD patients with a CI
- The medical records were reviewed to collect:
  - Demographic information
  - Etiology and duration of hearing loss
  - Surgical Findings
  - Pre-operative audiometric data
  - Post-implant audiometric data
  - Device use by data logs
- Patients who were not native English speakers and deceased patients were excluded.
- A prospective telephone survey (Table 2) was performed for included patients.
- Regret associated with obtaining CI was measured using the validated Decision Regret Scale (Table 3)
- Statistical analysis was performed to compare data from the SSD and BHL groups
  - Continuous and ordinal data were compared using a Wilcoxon rank-sum test
  - Categorical data were compared using Fisher's exact test or chi-square test
- Pearson correlation was performed to identify factors associated with post-operative performance.

RESULTS

Table 1: Response Rate and Patient Characteristics

	BHL (n=10)	SSD (n=19)	p-value
Overall response rate	10/67 (15%)	19/68 (28%)	0.093
Age at interview, years; mean (SD)	68.5 (18.3)	56.2 (12.5)	0.012
Sex, female (%)	40.0	57.9	0.45
Age at implantation, years; mean (SD)	67.3 (11.5)	52.0 (11.7)	0.042
Duration of deafness, years; mean (SD)	2.4 (2.9)	1.8 (2.2)	.525
Experience with CI, years	5.7 (3.9)	5.0 (3.4)	0.595
Laterality, left ear (%)	20.0	68.4	0.021
Datalogging CI Use, hours/day; mean (SD)	14.1 (1.08)	9.3 (4.3)	0.001
Implanted Ear PTA, dB HL; mean (SD)	95.8 (21.4)	87.7 (23.4)	0.82
Contralateral Ear PTA, dB HL; mean (SD)	71.0 (21.2)	14.2 (8.4)	<.001
Pre-operative aided CNC %; mean (SD)	7.8 (11.2)	14.6 (18.4)	0.348
Post-implant CNC %; mean (SD)	78.0 (23.1)	46.2 (24.9)	0.004

Figure 1: Pre-operative Audiometry Averages

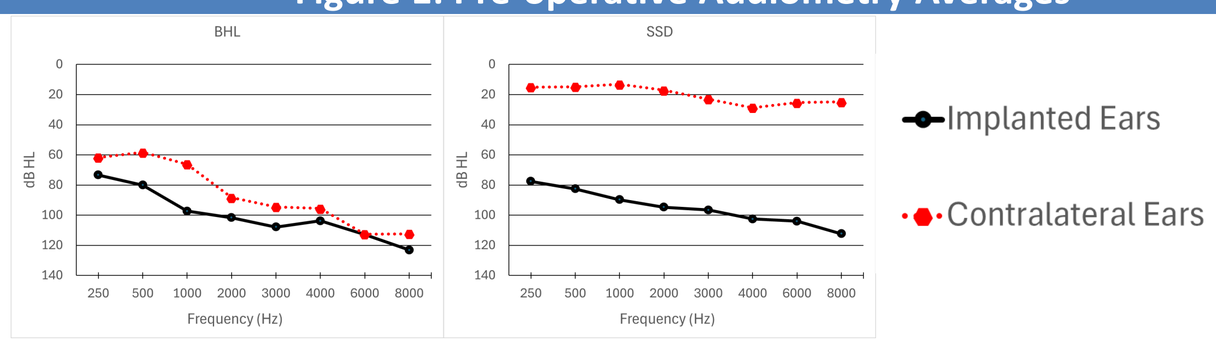


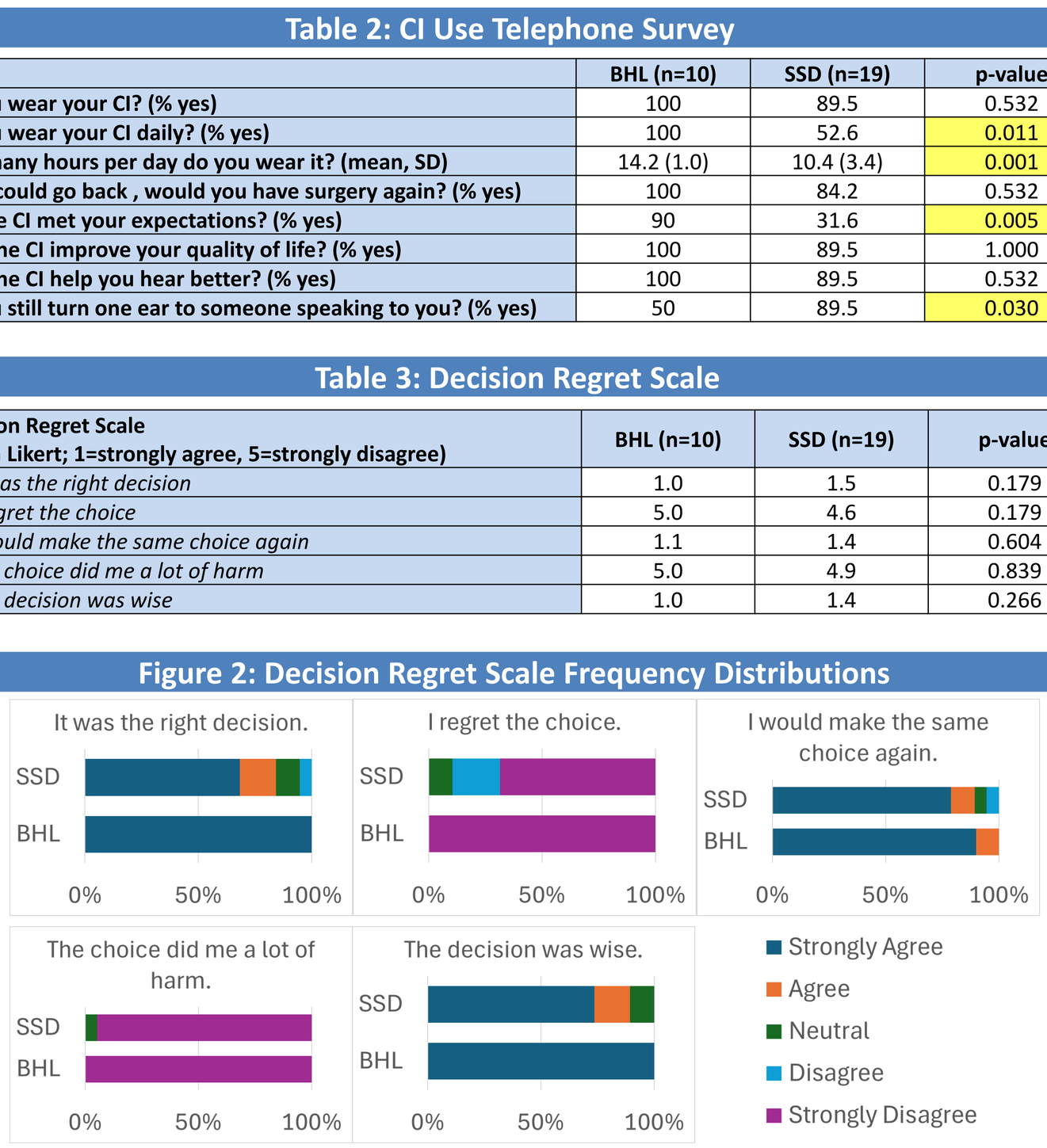
Table 2: CI Use Telephone Survey

	BHL (n=10)	SSD (n=19)	p-value
Do you wear your CI? (% yes)	100	89.5	0.532
Do you wear your CI daily? (% yes)	100	52.6	0.011
How many hours per day do you wear it? (mean, SD)	14.2 (1.0)	10.4 (3.4)	0.001
If you could go back , would you have surgery again? (% yes)	100	84.2	0.532
Has the CI met your expectations? (% yes)	90	31.6	0.005
Does the CI improve your quality of life? (% yes)	100	89.5	1.000
Does the CI help you hear better? (% yes)	100	89.5	0.532
Do you still turn one ear to someone speaking to you? (% yes)	50	89.5	0.030

Table 3: Decision Regret Scale

Decision Regret Scale (Mean Likert; 1=strongly agree, 5=strongly disagree)	BHL (n=10)	SSD (n=19)	p-value
It was the right decision	1.0	1.5	0.179
I regret the choice	5.0	4.6	0.179
I would make the same choice again	1.1	1.4	0.604
The choice did me a lot of harm	5.0	4.9	0.839
The decision was wise	1.0	1.4	0.266

Figure 2: Decision Regret Scale Frequency Distributions



DISCUSSION/CONCLUSIONS

- SSD patient had significantly fewer CI usage hours than BHL patients by datalogging and by self report.
- SSD patients are significantly less likely to meet their expectations with CI than BHL patients.
- SSD patients had more variability in their responses on the decisional regret scale.
- SSD patients are less likely to be satisfied with CI than BHL patients and are at risk of becoming non-users
- Careful counseling on expectations is essential for SSD patients considering CI.

Table 4: Correlations of SSD Post-Implant Performance

	Post-implant CNC Pearson	p-value
Age at implantation	-0.388	0.138
Datalogging Use	-0.015	0.958
Pre-op CNC	0.160	0.570
Experience with CI	0.057	0.833
Duration of Deafness	0.239	0.271

ACKNOWLEDGEMENTS

- Hillary Snapp, AuD, PhD (University of Miami)
- Emily Spitzer, AuD (NYU)

REFERENCES

- Oh SJ, Mavrommatis MA, Fan CJ, et al. Cochlear Implantation in Adults With Single-Sided Deafness: A Systematic Review and Meta-analysis. Otolaryngology Head Neck Surg, 2022.
- Grossmann W, Brill S, Moeltner A, Mlynski R, Hagen R, Radeloff A. Cochlear Implantation Improves Spatial Release From Masking and Restores Localization Abilities in Single-sided Deaf Patients. Otol Neurotol, 2016.
- Brehaut JC, O'Connor AM, Wood TJ, et al. Validation of a Decision Regret Scale. Med Decis Making, 2003
- Hanauer DA, Mei Q, Law J, Khanna R, Zheng K. Supporting information retrieval from electronic health records: A report of University of Michigan's nine-year experience in developing and using the Electronic Medical Record Search Engine (EMERSE). J Biomed Inform, 2015