ANNUAL REPORT 2022

Surgical Hearing Implant Program

Otolaryngology – Head & Neck Surgery

Report Prepared and Compiled by: Justyn Pisa, AuD, Program Coordinator

SHIP Annual Report
Health Sciences Centre
Shared Health

MANITOBA'S COCHLEAR IMPLANT COMMUNITY

2022 Annual Report

Surgical Hearing Implant Program

Shared health Soins communs Manitoba

University of Manitoba

Message from the Director

by Dr. Jordan Hochman – SHIP Director

We are so pleased for the return of near normal patient care. It has been a most challenging several years. This past year has seen increased productivity with active patient and provider engagement. Surgical volumes have recovered.

We have seen a surge in patient interest in cochlear implantation, almost doubling our historical monthly clearance rate to nearly 5 new candidates per month. The Operating Theatre and Leadership at the Health Sciences Centre have enabled us to maximize implant-related surgical procedures to ensure reasonable patient wait times are maintained.

Our surgical and clinical teams have been active in research projects, with peer-reviewed publications as well as international abstract presentations.

The Surgical Hearing Implant Program continues to benefit from a dedicated and inter-disciplinary team of professionals who have consistently delivered high standards of care for over almost 12 years!

We have managed to address a significant international vendor recall with 61 devices being impacted; A production deficiency that permits fluid ingress and shorting of the device circuitry. This has certainly strained the capacity of the Central Speech and Hearing Clinic to monitor these individuals. We are most pleased that patients requiring reimplantation as a consequence of this problem have outcomes that outperform most standard metrics.

2022 also saw new provincial funding for our adult cochlear implant patients. Assistance is now available for the purchase of replacement external sound processing equipment; one of the most generous programs in the Country.

I would like to express my gratitude to our team members at HSC as well as at our offsite location, the Central Speech & Hearing Clinic for a very productive year. I look forward to new accomplishments and challenges in 2023 and beyond!

Cochlear Implant Summary

A detailed description of cochlear implant surgical production for 2022, including information on program finances, changes in wait times and the current adult waiting list.

Page 3

Bone Conduction Device Summary

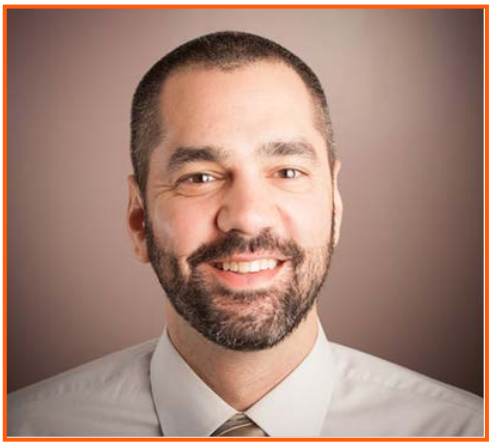
A detailed description of bone anchored implant surgical production for 2022, including information on program finances, changes in wait times and the current wait list.

Page 4

Program Personnel

- Jordan Hochman MD – Adult CI Surgeon
- Darren Leitao MD – Pediatric CI Surgeon
- Les Garber MD – BCHD Surgeon
- Justyn Pisa AuD – Program Coordinator
- Kristy Mackie MSc – Audiologist
- Daniela Stangherlin AuD – Audiologist
- Jacob Sulkers MSc – Audiologist
- Janelle Kent MSc – AV Therapist
- Debbie Brown MSc – AV Therapist
- Kelly Boyd – Clinic Office Manager
- Pam Campbell – ED, Central Speech

CI = Cochlear Implant
BCHD = Bone Conduction Hearing Device
AV = Auditory-Verbal



JUSTYN PISA – PROGRAM COORDINATOR

Justyn Pisa is an implant audiologist and has been the coordinator of SHIP since the program was initiated in 2011.

JPISA@HSC.MB.CA
204-787-5039

Coordinator Program Summary

by Justyn Pisa AuD, Program Coordinator

The following report will outline the current status of the Surgical Hearing Implant Program (SHIP) of the Department of Otolaryngology – Head & Neck Surgery at Health Sciences Centre (HSC) as of December 31, 2022.

The Cochlear Implant program has generated a record number of new candidates in 2022 with a total of **57** individuals, or **4.9 per month**! This helped SHIP achieve a new surgical output record of **40 new cochlear implant procedures** for the 2022 calendar year. An additional 16 revision surgeries were performed in 2022 as well, another record for the program.

Despite the increased number of surgical candidates, our surgeons helped the program successfully manage the adult wait list, keeping the average wait time on par with the national average, at **15.5 months**.

The Bone Conduction Program also broke records in 2022, with **19 surgical procedures** during the calendar year, largely stemming from the popularity and effectiveness of new trans-cutaneous implant systems. Our program has now implanted **23 individuals** with this device, making us the lead among all other Canadian centres with this type of implant.

The additional funding received to assist with sound processor upgrades for our adult CI recipients, was extremely well-received by our implant community. The 80% coverage every 5 years, represents one of the most generous implant-related benefits in Canada and ensures Manitoba's CI recipients of all ages will continue to benefit from their implants, regardless of cost. See more details about this tremendous new program on Page 5.

CI Sound Processor Upgrades

In 2021, a total of **12** pediatric patients were granted **12** cochlear implant sound processor upgrades through the Pediatric Sound Processor Replacement Program. This program provides 80% of the cost towards processor upgrades for pediatric recipients every 5 years. Since 2013, the program has processed **82** applications for a total of **86** sound processors.

In 2022, SHIP received new annual funding to extend the sound processor upgrade benefit to Manitobans of all ages! This patient-led effort drew attention to the high cost of replacement equipment which led government to provide over $350,000 in additional funding for this program. Receiving 80% of the upgrade cost every 5 years, now provides adult recipients with one of the most generous hearing-related benefits in Canada! See more details about this exciting new program on Page 5.

CI Revision Surgeries

The management of the Advanced Bionics V1 electrode recall continued into 2022, with additional pediatric and adult revision surgeries. SHIP re-implanted **12** CI recipients with new electrode technology in 2022, a **90%** increase in revision surgeries from 2021. To date, SHIP has identified **39** individuals (out of 61) with a defective V1 electrode with a current **revision rate of 30%** for the entire affected cohort. See more results on Page 6.

In addition to the V1 electrode recall, routine revision surgeries continue to grow as our program and patient devices age. A total of **4 revision surgeries** were performed in 2022 to replace obsolete internal electrodes, 4 times the number performed in 2021. SHIP will continue to closely monitor all cochlear implant recipients to ensure revision cases receive priority and are expedited to ensure high quality patient care.

Cochlear Implant Summary

The Cochlear Implant (CI) Program completed **40** surgical procedures in 2022. These surgeries included **37** unilateral procedures and **3** bilateral procedures on **29** adult patients and **11** pediatric patients (**43 devices total**). Since the start of the program, SHIP has implanted a total of **423** cochlear implants on **392** individual patients.

Wait Times

Due in part to the "re-opening" following Covid-19 restrictions, patient interactions significantly increased in 2022 compared to the previous year. The cochlear implant program generated a new average **4.91** new surgical candidates per month, almost a **100% increase** over historical norms.

The average wait time is expected to rise to approximately **15.5** months by the end of 2022 due to personnel and resource shortages from the ongoing pandemic.

Revision Cases

A total of **16** patients were re-implanted using **16** electrodes over the course of 2022. This included 3 pediatric and 8 adult recipients. These patients were mostly comprised of the V1 device recall cohort from SHIP's primary vendor, however routine revision surgeries are increasing each year as implants naturally age and require replacement. Revision surgeries in 2022 accounted for **12% of surgical output** for the calendar year. A cost recovery for disposables exists within the contract with the vendor.

Program Research

The Surgical Hearing Implant Program is currently undertaking several retrospective reviews of previously implanted patient cohorts to better identify potential candidates and more accurately measure outcomes.

One study, presented by Dr. Erika Lee at the American Academy of Otolaryngology meeting in Los Angeles, CA, involved an analysis of the effect of comorbidity on post-operative outcomes in the program's lowest performers. This research was recently accepted for publication by the Laryngoscope Journal of Investigative Otolaryngology.

In a separate study, Dr. Walleed Almutairi examined the effects of a vendor electrode recall on electrical impedance levels and relative decline in patient performance, which was presented at the Combined Otolaryngology Spring Meeting (COSM) in Dallas, TX and is awaiting publication.

At the American Academy of Otolaryngology conference in Philadelphia, PA, medical student Tessa Bortoluzzi presented on the reduction in speech understanding in patients with self-selected deactivated electrodes. This work also won first place at the Canadian Association of Women's Surgery conference and is slated for publication in early 2023.

In the Robotics and Simulation lab, bioengineering graduate student Josée Rosset continues work on developing a classifier to aid in the evaluation of surgical techniques on 3D printed and virtual bone models, with hopes to further develop an augmented reality model for future surgical trainees.

SHIP is also participating in 2 separate vendor-driven research projects using select patient cohorts, including a study evaluating the use of remote patient assessment and another evaluating post-operative performance for those with single-sided deafness, an emerging patient cohort that is relatively new to this technology.

43

2022 Cochlear Implant Production

Including revision cases, the surgical hearing implant program utilized **43** cochlear implant devices on **40** individual patients in the 2022 calendar year. This represents a **29% increase** in surgical output from 2021.

4.9

Adult CI Candidates per Month

SHIP cleared an average of **4.94** new cochlear implant candidates per month in 2022. Historically, this represents a significant increase in new candidates per month (average was previously 3 per month). As a result, the adult wait list has grown to approximately **50** patients with a projected increase in average wait time of 14 months per patient.

423

Cochlear Implants in Manitoba

Since 2011, SHIP has implanted **423** new devices on **392** CI recipients of all ages. The bilateral implant rate is **40%** (40/99) for pediatric recipients and **6%** (19/300) for adult recipients.

Bone Conduction Summary

The Bone Conduction Hearing Device (BCHD) Program completed **19** surgeries in 2022. There were **17** adult cases and **2** pediatric cases, with one being a sequential bilateral procedure. Since the start of the program, SHIP has implanted a total of **151** bone anchored implants on **150** individual patients.

Wait Times

The bone anchored implant program generated an average monthly candidacy clearance rate of **1.6** new surgical candidates per month. This represented an average increase of .5 new candidates per month compared to previous years, and may be due to advancements in bone conduction technology which has improved overall size and cosmesis of these devices.

The average wait time for bone anchored implant surgery is expected to increase **2.0** months from the previous year. Considering BCHD production over the past two years, the overall wait times for adult patients has remained fairly consistent due to successful RFP negotiations with implant vendors to retain competitive pricing.

Bilateral Implantation

2022 saw SHIP's first sequential bilateral bone conduction implantation procedure on a 12-year old pediatric patient. This patient has bilateral atresia and associated maximum conductive hearing loss, so was unable to wear conventional amplification. Originally implanted with older percutaneous devices, this patient suffered from chronic infection around the implant sites due to reactions from the abutment that protruded through the skin to the skull. As a result, we elected to re-implant this patient with a bilateral transcutaneous system.

This new option successfully alleviated chronic skin infection issues as the system transmits the amplified signal electromagnetically through skin and soft tissue, without any abutment that protrudes through the skin.

Fig.1. *New transcutaneous bone conduction implant system that generates the amplified signal underneath the skin and soft tissue*.

The amplified signal is then transmitted by the internal implant which is osseointegrated directly with the bone of the skull using a 4mm titanium screw. This means that recipients experience all of the benefits of a traditional abutment-based system without an open wound that can lead to recurrent infection. It is likely that more patients will choose this alternative bone conduction option going forward due to the auditory and physical benefits.

Industry Update

Unfortunately, SHIP's primary bone conduction vendor decided to divest that aspect of their business to a major competitor midway though 2022. Although we were disappointed in this decision, the new vendor is a leader in the industry with a full compliment of products available for our program and patients.

We are confident that we can solidify our relationship with this new vendor going forward to ensure access to quality products at competitive prices for our patient base into the future.

19

2022 BCHD Production

The surgical hearing implant program utilized **19** bone conduction hearing devices on **19** individual patients in the 2022 calendar year. This production represents a **72% increase** in surgical output from 2021.

1.6

BCHD Candidates per Month

SHIP cleared an average of **1.6** new bone conduction surgical candidates per month in 2022. This is an increase from our historical average of **13** new BCHD candidates per year (1.2 per month). The current wait list is projected to be **19** patients by the next fiscal year in April, 2022.

151

Bone Conduction Implants in MB

Since 2011, SHIP has implanted **151** new bone conduction devices on **151** recipients. There are approximately 25 additional individuals currently using bone conduction technology that are followed by our implant audiologists at the Central Speech & Hearing Clinic.

Clinician's Corner: *Adult Sound Processor Upgrades*

SHIP Contact Information

- Justyn Pisa, Au.D.
  Program Coordinator
  jpisa@hsc.mb.ca
  Department of Otolaryngology
  Health Sciences Centre
  GB 421 | 820 Sherbrook Street |
  Winnipeg, MB | R3A 1R9
  Phone 204-787-5039
  Fax 204-787-5109

- Adult Implant Clinic (Clinic G)
  Heather Martens – CI Administrator
  hmartens3@hsc.mb.ca
  Frances Magill – BAHA Administrator
  fmagill@hsc.mb.ca
  Department of Otolaryngology
  Health Sciences Centre
  820 Sherbrook Street
  Winnipeg, MB | R3A 1R9
  Phone 204-787-5115 (ext. 0)
  Fax 204-787-1727

- Pediatric Implant Clinic (CK2)
  Cristina Baldino – Administrator
  cbaldino@hsc.mb.ca
  Department of Otolaryngology
  Children's Hospital
  840 Sherbrook Street
  Winnipeg, MB | R3A 1R9
  Phone 204-787-5115 (ext. 0)
  Fax 204-787-1727

- Central Speech & Hearing Clinic
  Kelly Boyd – Administrator
  kboyd2@hsc.mb.ca
  #2 – 1325 Markham Rd
  Winnipeg, MB | R3T 4J6
  Phone: 204-275-7436
  Fax: 204-269-5083

- Department of Otolaryngology
  Emi Okamoto – Administrator
  eokamoto@hsc.mb.ca
  GB421 – 820 Sherbook St
  Winnipeg, MB | R3A 1R9
  Phone: 204-787-3349
  Fax: 204-787-5109

Patient-Led Initiative

In the Fall of 2021, a small but vocal group of patients with hearing impairment gathered on the steps of the Legislature building to draw attention to the lack of available financial assistance in Manitoba for adult cochlear implant (CI) recipients. Although the initial cochlear implant and external sound processor are a covered health benefit in Manitoba, adult patients have been responsible for the replacement cost of their external equipment, which can often exceed $10,000 per ear every 5-6 years. A pediatric funding program has been in place for patients since 2013, but this benefit unfortunately did not extend to adults.

The good news is that the Provincial government heard those patient concerns and immediately recognized them as a legitimate issue for cochlear implant recipients across Manitoba. By the Spring, 2022 a new Sound Processor Upgrade Program was announced which provided $352,000 in annual funding to adult CI recipients, paying 80% of the cost for each device, every 5 years.

***Gladys Nielsen**, Past-President of the Manitoba Chapter of the Canadian Hard of Hearing Association, led the effort to highlight the lack of assistance available to adult CI recipients in Manitoba. Seen here announcing the funding program with **Audrey Gordon**, Minister of Health, and **Obby Kahn**, MLA for Forth Whyte.*

Progress

Despite some challenges in creating the infrastructure for administration of this new program, SHIP was able to start accepting new applications in Summer, 2022. Patient feedback has been extremely positive and we have been inundated with requests for assistance.

A typical CI activation includes hearing new sounds for the first time (or the first time in many years). Patients report noise, then squeals, and finally voices as they become accustomed to the new sound.

In examining our existing cochlear implant community, Manitoba has approximately 500 CI recipients with over 225 adults currently eligible for a sound processor upgrade. Needless to say, our program, in conjunction with the Central Speech & Hearing Clinic have been very busy in triaging patients based on processor age, processing new applications, and scheduling device activation appointments

Future Outlook

Due to the high level of demand for this patient population, we plan on prioritizing patients based on need while still accommodating our pediatric patient cohort. While a very welcome advancement for our cochlear implant community, this new funding has placed additional workloads on our clinicians, so a long-term solution for the permanent administration of the adult sound processor upgrade program is still evolving.

Clinician's Corner: *V1 Recall - Revision Surgeries*

Introduction

In February 2020, Advanced Bionics (AB) initiated a field action notice to remove the MS Ultra (V1) implant from circulation. In this study, we quantify a single site's incidence with device failure and examine the relationship between impedance change and declining speech perception. To date, 39/69 (58%) internal devices have a confirmed failure. Current revision rate is 30% (20/69 devices).

Participants

20 cochlear implant recipients implanted between October 2017 to December 2019 with the Exclusion Criteria included: medical/surgical failures and lack of English language proficiency.

Methods

20 participants have been re-implanted with a new electrode. Post-operative speech perception (AzBio sentence test) scores at 12 months post-activation were compared with scores recorded at 12-months with the original (pre-recall) electrode, as well as the original electrode once failure was detected. Device failures were confirmed by a significant decline in impedance levels and AzBio speech perception scores, as well as through internal analysis completed by the manufacturer.

Results

Baseline average speech perception score with the defective electrode at 12-months post-activation was 63.5% [± 25%] (Figure 1). To date, 58% (39/69) of devices have met all three criteria for a confirmed failure. Average speech perception score at time of failure detection was 45.1% [± 22%] (Figure 1). A total of 20 devices have been re-implanted on 19 participants with an average speech perception score at 12-months post-activation of 71% [± 19%].

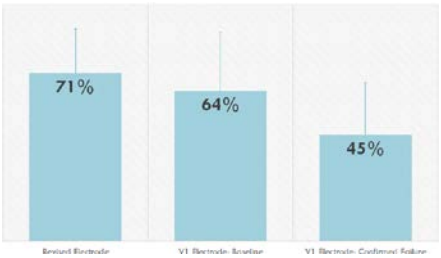


Fig.1. *Average speech-perception scores (AzBio) with revised electrode (column 1), original pre-recall electrode (column 2) and failed electrode (column 3).*

Comparing the difference in speech perception scores between the revised and failed electrodes, participant performance has improved an average of 26% [± 22%] (Figure 2). Fortuitously, participants are also performing an average of 8% better than their baseline measurement with the previous electrode.

Results

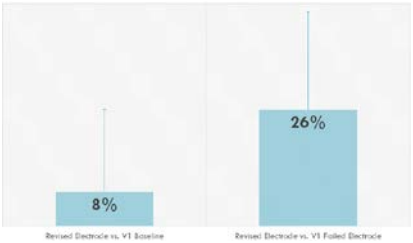


Fig. 2. *Net-Benefit from the re-implanted electrode vs. original pre-recall electrode (column 1) and failed electrode (column 2).*

Conclusion

While we found no direct relationship between absolute impedance level change and speech perception scores, it is clear that the affected V1 electrodes were significantly impacting the audibility of softer inputs as well as real-world speech understanding for participants.

This study quantified cochlear implant failure rates at a single centre and examined the relationship of impedance change as a precursor to declining speech perception for V1 recipients. While lowered impedances were indicative of declines in audibility and speech understanding, no predictive relationship was found between degree of impedance change and speech perception scores.

Meet our Implant Audiologists!

Kristy Mackie (top left), Daniela Stangherlin (bottom left), and Jacob Sulkers have been dedicated to our implant patients since 2007! Their expertise in implant technology and patient management is unmatched in the province. We are extremely lucky to have such skilled Audiologists delivering excellence in care for those with severe-to-profound hearing impairment.

Kristy, Daniela, and Jacob offer implant-based services to patients of all ages from the Central Speech and Hearing Clinic.
1325 Markham Road – Ph: 204-275-7436 – Fax: 204-269-5083

SHIP Research: Conference Presentations

Hochman J., Unger B., Kraut J., Hombach-Klonish S. Gesture-Controlled Three-Dimensional Anatomy: A Novel Teaching Tool in Head and Neck Surgery. American Academy of Otolaryngology Annual Meeting. Washington DC. September 2012.

Kraut J, Hochman JB, and Unger B. 2013. Temporal bone surgical simulation employing a multicore architecture. Proceedings of 2013 26th Annual IEEE Canadian Conference on Electrical and Computer Engineering (CCECE – Regina, SK) pp. 1–6.

Wong D, Hochman J, Unger B, Kraut J. Face and Content Validation of a Rapid Prototyped Temporal Bone Model. Presented at the 2013 Annual Canadian Society of Otolaryngology - Head & Neck Surgery Meeting, June 2-4. Banff, AB.

Wong D, Hochman J, Unger B, Kraut J. Soft Tissue Modeling in Temporal Bone Simulation. Presented at the 2013 Annual Canadian Society of Otolaryngology - Head & Neck Surgery Meeting, June 2-4. Banff, AB.

Wong D, Hochman J, Unger B, Kraut J. Controlled Interactive Three-Dimensional Anatomy: A Novel Teaching Tool in Head and Neck Surgery. Presented at the 2013 Annual Canadian Society of Otolaryngology - Head & Neck Surgery Meeting, June 2-4. Banff, AB.

Le T., Leitao D., Hochman J. Hair Barrette Induced Cochlear Implant Receiver Stimulator Site Infection with Extrusion. Canadian Society of Otolaryngology, Banff Ab, June 2013.

Kraut J., Unger B., Hochman J. Temporal Bone Surgical Simulation Employing A Multicore Architecture. Canadian Conference on Electrical and Computer Engineering, Regina SK, June 2013.

Unger B, Kraut J, Hochman JB. A Novel Rapid Prototyped Temporal Bone Model for Surgical Dissection. American Academy of Otolaryngology Annual Meeting. Vancouver BC. Sept. 2013.

Unger B., Kraut J., Hochman J. Comparison of Isomorphic 3D Printed and Virtual Haptic Temporal Bone Simulation in Education. Simulation Summit, RCPSC, Vancouver BC, Nov. 2013.

Wong D., Kraut J., Unger B., Hochman JB. Comparison of Isomorphic 3D printed and Virtual Haptic Temporal Bone Simulation. Canadian Society of Otolaryngology (CSO), Ottawa ON, May 2014.

Wong D, Unger B, Kraut J, Hochman J. Comparison of Cadaveric and Isomorphic Virtual Haptic Simulation in Temporal Bone Education. Presented at the 2014 Annual Canadian Society of Otolaryngology - Head & Neck Surgery Meeting, May 11-13. Ottawa, ON.

Bertram J. Unger, Kraut J, Hochman J. Design and Validation of 3D Printed Complex Models with Internal Anatomic Fidelity for Training and Rehearsal. Medicine Meets Virtual Reality. Manhattan Beach CA. Feb 2014.

Hochman J, Rampersad V, Sepehri N, Kraut J, Pisa J, Unger B. Import of Haptic Manipulandum & Device Fidelity on Expert User Perception in Virtual Temporal Bone Surgery. Presented at 2015 Annual Combined Otolaryngology Spring Meetings (COSM) April 22-25; Boston, MA.

Hochman J,. Kraut J., Pisa J., Rhodes C., Unger B. Comparison of Anatomically Matched 3D Printed and Virtual Haptic Temporal Bone Simulation. Combined Otolaryngology Spring Meeting COSM, May 2014, Las Vegas, NV.

Hochman J, Tordon B, Unger B, Pisa J. Importance of Stereoscopy in Haptic Simulation for Temporal Bone Surgical Training. Presented at the 2015 Annual Canadian Society of Otolaryngology - Head & Neck Surgery Meeting, June 6-9. Winnipeg, MB.

Hochman J, Rampersad V, Sepehri N, Unger B, Pisa J. Import of Haptic Manipulandum and Device Fidelity on Expert User Perception in Virtual Temporal Bone Surgery. Presented at the 2015 Annual Canadian Society of Otolaryngology - Head & Neck Surgery Meeting, June 6-9. Winnipeg, MB.

Moore P., Hochman J., Blakley B. Vestibular Hypofunction as an Indicator of Lateral Skullbase Pathology. Canadian Society of Otolaryngology (CSO), Winnipeg Canada, June 2015.

Pisa J, Sulkers J, Butler J, West M, Hochman J. Impact of Stereotactic Radiosurgery on Cochlear Implant Performance in Patients with Neurofibromatosis Type II. Presented at the 2016 Annual American Cochlear Implant Alliance Conference. May 11-14, Toronto, ON.

Hochman J, Unger B, Pisa J, Fliker A. Mixed Reality Simulation. Presented at 2017 Annual AAO – HNSF Meeting & OTO Experience. September. Chicago, IL.

Kazmerik K, Unger B, Pisa J, Hochman J. Evaluation of Trainee Drill Motion Patterns during Temporal Bone Simulation with 3D Printed Models. Presented at 2017 Annual Combined Otolaryngology Spring Meetings (COSM) April 26-30; San Diego, CA.

Unger, B. Tordon, B., Pisa J., Hochman J. Importance of Stereoscopy in Haptic Training of Novice Temporal Bone Surgery. Medicine Meets Virtual Reality. Los Angeles CA, April 2016.

Kazmerick K, Pisa J, Gentile L, Unger B, Hochman J. Comparison of Drill Technique; Cadaveric and Printed Temporal Bone. Presented at 2017 Annual Combined Otolaryngology Spring Meetings (COSM) April 26-30; San Diego, CA.

Gousseau M, Unger B, Pisa J, Mowat S, Westerberg B, Hochman J. Validation of Novel Temporal Bone Dissection Scale. Presented at 2017 Annual Combined Otolaryngology Spring Meetings (COSM) April 26-30; San Diego, CA.

Sulkers J., Mackie K., Stangherlin D., Pisa J., Hochman J. Cochlear Implant Benefit by Age: Comparing Speech Perception Outcomes in Adults Implanted Prior to and After Seventy. ACI International Cochlear Implant Conference, Toronto ON, May 2016.

Hochman J., Pisa J., Rampersad V., Unger B., Sepheri N. The Effect of Haptic Force Resolution in Virtual Temporal Bone Surgery. American Academy of Otolaryngology Annual Meeting. San Diego. Sept. 2016.

Kazmerick K, Pisa J, Gentile L, Unger B, Hochman J. Printed Bone Hand Motion Analysis. Presented at 2017 Annual National Medical Students Research Forum. April. Galveston, TX.

Dolatabdi A.D., Hochman J., Mousavi Z., Unger B. Automated Assessment of Temporal Bone Surgical Simulation Employing an Improved Model of Bone-Drilling Force Feed Back. Euro Haptics. Pisa Italy. May 2018.

Wong V., Pisa J., Unger B., Hochman J. Construct Validation of a Printed Bone Substitute in Otologic Education. Canadian Society of Otolaryngology Meeting, Quebec City Quebec. June 2018.

Gigiotti D., Blakley B., Moore P., Hochman J. MRI is not Indicated in the Management of Isolated Vestibular Weakness. Canadian Society of Otolaryngology Meeting, Quebec City Quebec. June 2018.

Wong V., Pisa J., Unger B., Hochman J. Appraisal of a Printed Bone Substitute. American Academy of Otolaryngology Annual Meeting. Atlanta. Sept. 2018.

Pisa J. Hearing Health Care: An Investment in the Future. Presented for the Faculty of Medicine, University of Manitoba. Winnipeg, Manitoba. October, 2018.

SHIP Research: Conference Presentations

Singh S, Pisa J, Unger B, Hochman J. Distinct Temporal Bone Dissection Scales Demonstrate Equivalence in Distinguishing Trainee Performance. Presented at 2019 Annual COSM Spring Meetings. May 1-5; Austin, TX.

Wong, V, Pisa J, Hochman J. Construct Validation of a Printed Bone Substitute in Otologic Education. Presented at 2019 Annual COSM Spring Meetings May 1-5; Austin, TX.

Pisa J. Bone Conduction Hearing Devices – Practice and Pitfalls from a Canadian Implant Centre. Presented at 2019 Annual Conference for the Canadian Academy of Audiology (CAA). October 26-30; Halifax NS.

Davari, A. Automated Assessment of Trainee Temporal Bone Surgical Skill Employing Simulated Surgery. Presented for Thesis Defense, Faculty of Medicine, University of Manitoba. November 2019; Winnipeg, MB.

Singh S, Pisa J, Unger B, Blakley B, Leitao D, Jones J, Hochman J. Comparison of Summative Temporal Bone Dissection Scales Demonstrate Equivalence. Presented at AAO-HNSF 2019 Annual Meeting & OTO Experience, September 15-18; New Orleans, LA.

Andrews C, Hochman J, Pisa J. Rationing Rotational Magnet Cochlear Implant Technology in a Single Payer Healthcare System. Presented at the Combined Sections Meetings, Tri-logical Society. January 2020; Coronado, CA.

Andrews C, Pisa J, Andrews C. Imaging Needs in Cochlear Implant Recipients. Canadian Society of Otolaryngology Head and Neck Surgery, Fredericton NB, 2020

Hochman J. Cannabinoids in Management of Tinnitus. Canadian Society of Otolaryngology Head and Neck Surgery, Fredericton NB, 2020

Pisa J. Cochlear Implantation in Canada: Current Status and Future Outlook. Presented at 2020 Annual Conference for Speech-Language and Audiology Canada (SAC). December 2020 - Virtual

Hochman JB., Pisa J., Unger B., Singh S. Summative Temporal Bone Grading Schema. Canadian Society of Otolaryngology Head and Neck Surgery, Fredericton NB, 2020

Pisa J. Implantable Hearing Technologies. Presented at 2021 Annual Conference for the Canadian Academy of Audiology (CAA). November 2021 - Virtual

Hochman JB, Pisa J Lee E. Factors Associated with Limited Auditory Outcomes following Adult Cochlear Implantation. American Academy of Otolaryngology Annual Meeting. Las Angeles. Oct. 2021

Hochman JB, Pisa J, Lee E. Comorbid Implications to Device Function [poster]. Canadian Society of Otolaryngology Head and Neck Surgery, Virtual 2021

Hochman JB, Almutairi W, Pisa J. Cochlear Implants: When Hardware Fails. Canadian Society of Otolaryngology Head and Neck Surgery, Virtual 2021

Hochman JB, Pisa J, Davari M, Unger B. Development of a Hand-Stroke Detection Algorithm in Virtual Temporal Bone Simulated Surgery. American Academy of Otolaryngology Annual Meeting. Los Angeles. Oct. 2021

Hochman JB., Almutairi W., Pisa J. Electrical Signaling of Device Failure. Combined Otolaryngology Spring Meeting. Dallas Tx, May 2022

Lee E., Pisa J., Hochman JB. Comorbidity Associated with Worse Outcomes in a Population of Limited Cochlear Implant Performers. American Academy of Otolaryngology Annual Meeting, Los Angeles CA, 2022.

Almutairi W., Hochman JB., Pisa J. Impedance Changes as an Indicator of Cochlear Implant Failure. Combined Otolaryngology Spring Meeting. Dallas Tx, 2022.

Bortoluzzi T., Pisa J., Sulkers J., Hochman JB. Patient Directed Electrode Deactivation and Associated Diminished Audibility. American Academy of Otolaryngology Annual Meeting, Philadelphia, PA, 2022.

SHIP Research: Peer-Reviewed Publications

Forzley B, Chen J, Nedzelski J, Lin V, Shipp D, Godlovitch G, Hebert P, Hochman J. Considerations of Candidacy for Bilateral Cochlear Single Payer Universal Health Care System. Laryngoscope. 2013 Dec;123(12):3137-40.

Kraut J., Unger B., Hochman J. Temporal Bone Surgical Simulation Employing A Multicore Architecture. Electrical and Computer Engineering, 2013 26th Annual IEEE Conference. 10.1109/CCECE.2013.6567771, Page1-6.

Unger B., Kraut J., Hochman JB. Method and System for Rapid Prototyping of Complex Structures. United States Patent and Trademark

Unger BJ, Kraut J, Rhodes C, Hochman J. Design and Validation of 3D Printed Complex Bone Models with Internal Anatomic Fidelity for Surgical Training and Rehearsal. Stud Health Technol Inform. 2014; 196:439-45.

Hochman JB, Kraut J, Kazmerik K, Unger BJ. Mixed reality temporal bone surgical dissector: mechanical design. Otolaryngol Head Neck Surg. 2014 Mar;150(3):448-54.

Wong D, Unger B, Kraut J, Pisa J, Rhodes C, Hochman JB. Comparison of cadaveric and isomorphic virtual haptic simulation in temporal bone training. J Otolaryngol Head Neck Surg. 2014 Oct 13; 43:31.

Hochman JB, Sepehri N, Rampersad V, Kraut J, Khazraee M, Pisa J, Unger B. Mixed reality temporal bone surgical dissector: mechanical design. J. Otolaryngol. - Head Neck Surg. J. 2014; 43:20-23.

Hochman JB, Kraut J, Kazmerik K, Unger BJ. Generation of a 3D printed temporal bone model with internal fidelity and validation of the mechanical construct. Otolaryngol Head Neck Surg. 2014 Mar;150(3):448-54.

Hochman JB, Unger B, Kraut J, Pisa J, Hombach-Klonisch S. Gesture-controlled interactive three-dimensional anatomy: a novel teaching tool in head and neck surgery. J Otolaryngol Head Neck Surg. 2014; Oct 7; 43:38.

Le T., Leitao D., Hochman JB. Hair Barrette Induced Cochlear Implant Receiver Stimulator Site Infection with Extrusion Case. Rep Otolaryngol. 2015; 51074.

Hochman JB, Rhodes C, Kraut J, Pisa J, Unger B. End User Comparison of Anatomically Matched 3-Dimensional Printed and Virtual Haptic Temporal Bone Simulation: A Pilot Study. Otolaryngol-Head Neck Surg. 2015; 153:263–268.

Szturm T., Reimer K., Hochman J. Home-Based Computer Gaming in Vestibular Rehabilitation of Gaze and Balance Impairment. Games for Health J. 2015 Jun;4(3):211-20.

Hochman JB, Rhodes C, Kraut J, Pisa J, Unger B. Design and Validation of 3D Printed Complex Bone Models with Internal Anatomic Fidelity for Surgical Training and Rehearsal. Otolaryngol Head Neck Surg. 2015; Aug;153(2):263-8.

Szturm T, Hochman J, Wu C, Lisa L, Reimer K, Wonneck B, Giacobbo A. Games and Tele-rehabilitation for Balance Impairments and Gaze Dysfunction: Protocol of a Randomized Controlled Trial. JMIR Res Protoc. 2015 Oct 21;4(4): e118.

Hochman JB, Rhodes C, Wong D, Kraut J, Pisa J, Unger B. Comparison of cadaveric and isomorphic three-dimensional printed models in temporal bone education. Laryngoscope. 2015 Oct;125(10):2353-7.

Unger B., Torodon B., Pisa J., Hochman J. Importance of Stereoscopy in Haptic Training of Novice Temporal Bone Surgery. Stud Health Technol Inform. 2016; 220:439-45.

Pisa J, Sulkers J, Butler J, West M, Hochman J. Stereotactic Radiosurgery does not appear to Impact Cochlear Implant Performance in Patients with Neurofibromatosis Type II. Journal of Radiosurgery & SBRT. 2017. July.

Unger B, Sepehri N, Rampersad V, Pisa J, Gousseau M, Hochman J. Elements of Virtual Temporal Bone Surgery: Manipulandum Format may be More Important to Surgeons than Haptic Device Force Capabilities. Laryngoscope Investig Otolaryngol. 2017. Oct 2:29

Pisa J, Gousseau M, Mowat S, Westerberg B, Unger B, Hochman JB. Simplified Summative Temporal Bone Dissection Scale Demonstrates Equivalence to Existing Measures. Ann Otol Rhinol Laryngol. 2017 Nov 1:348.

Hochman JB, Pisa J, and Cham, B. Prioritization of Re-implantation in Previously Successful Cochlear Implantation Following Natural Device Failure. Otology & Neurotology, 2018, Vol.39(8), p.651-653.

Wong, V, Unger B, Pisa J, Gousseau M, Westerberg B, Hochman J. Construct Validation of a Printed Bone Substitute in Otologic Education. Otology & Neurotology, 2019, Vol.40(7), pp. e698-e703.

Singh S, Pisa J, Unger B, Leitao D, Jones J, Blakley B, Hochman J. Comparison of Summative Temporal Bone Dissection Scales Demonstrate Equivalence. Otolaryngol Head Neck Surg. 2019

Pisa J, Andrews C, Hochman J. Rationing Rotational Magnet Cochlear Implant Technology in a Single Payer Healthcare System. Annals of Otology, Rhinology & Laryngology, 2020-07-22, p.3489-3492

Mowry S, Jabbour N, Rose A, Wiet G, Svrakic M, A Zopf D, Vankoevering K, Powell A, Freiser M., Hochman JB, Smith R. Multi-institutional Comparison of Temporal Bone Models: A Collaboration of the AAO-HNSF 3D-Printed Temporal Bone Working Group. Otolaryngol Head Neck Surg. 2021 May;164(5):1077-1084

Hochman JB, Pisa J, Kazmerik K, Unger B. Hand Motion Analysis Illustrates Differences When Drilling Cadaveric and Printed Temporal Bone. Ann Otol Rhinol Laryngol, 2021 Dec 7;34-38.

Hochman JB, Pisa J, Singh S, Gousseau M, Unger B. Comparison of Summative Temporal Bone Dissection Scales Demonstrate Equivalence. Int. Arch. Otorhinolaryngol., 2021 Dec.

Lee E., Pisa J., Sulkers J., Hochman JB. Comorbidity Associated with Worse Outcomes in a Population of Limited Cochlear Implant Performers. Laryngoscope Investigative Otolaryngology. December 2022

Pisa J., Almutairi W., Sulkers J., Hochman JB. Impedance Changes as an Indicator of Cochlear Implant Failure. Otology Neurotology, submitted 2022.

Bortoluzzi T., Pisa J., Sulkers J., Hochman JB. Patient Directed Electrode Deactivation and Associated Diminished Audibility. Otolaryngology – Head & Neck Surgery, submitted 2022.

Hochman J., Rosset J., Davari M., Pisa J., Unger B. Autonomous Classification in Temporal Bone Surgical Education. Laryngoscope, submitted 2022.

Davari M., Unger B., Pisa J., Hochman JB. Stroke Detection Algorithms in Temporal Bone Simulation. Manuscript.

Davari M., Unger B., Pisa J., Hochman JB. Import of Recreational Gaming in Virtual Temporal Bone Surgery. Manuscript.

Davari M., Unger B., Pisa J., Hochman JB. Development of a Temporal Bone Virtual Classifier. Manuscript.