APRIL 29, 2022

Meet the Team - Audiology

Laura Greaver, Au.D.

Children's Hospital Colorado
Here, it's different.™

CI Candidacy Evaluation – Roadmap

BILL DANIELS CENTER FOR CHILDREN'S HEARING

Cochlear Implant Roadmap

Children's Hospital Colorado

Phase 1: Initial consultation and evaluations

Start here

You have been referred to us by your child's care team for cochlear implants. Together we'll discuss your child's diagnosis and determine best next steps for your child and family.

First, you'll meet with an audiologist to introduce cochlear implants and answer any questions you may have. We'll conduct hearing tests to confirm your child's diagnosis and you'll meet with the rest of the team to learn more about the process and expected outcomes. Our work around cochlear implants is a team effort, and we are dedicated to understanding your child's needs and overall health holistically.

Some tests your child may undergo:

- ENT consultation
- Speech-language evaluation
- MRI
- CT
- Social work consultation
- Meeting with family resource and/or teacher of the deaf/ hard of hearing
- Ultrasound
- Eye exam
- Neurology exam
- Developmental exam

Then, our cochlear implant team will review your child's case to make recommendations and, if appropriate, create a plan for surgery.

Throughout your journey, you'll have access to a team of multidisciplinary specialists including audiologists, otolaryngologists, speech language specialists, teachers of the deaf/hard of hearing, social workers, child life specialists, a family resource coordinator and more.

Phase 2: Preparing for surgery

Our audiologists will walk through your hearing technology options and help to pick out any external equipment that will best suit your child's needs.

Before surgery, our team will also help prepare families to properly use equipment and share more about the surgery process, outcomes and expectations, and follow-up care.

Once you've selected your hearing device, we'll schedule your surgery. At this time, we'll confirm your child is up to date on required vaccinations and help schedule any appointments if boosters or additional vaccinations are required.

Our child life specialists are here to offer additional support and to help reduce any anxiety a child may feel in preparing for implantation.

Phase 3: Surgery

Surgery lengths vary depending on the complexity of your case but be prepared for a long day. Our surgeons take extra care to ensure that their work is done meticulously to achieve the best outcomes for your child.

Phase 4: After surgery

Depending on your child's case, they may be able to go home the same day as their surgery or might stay with us for the night.

Most kids have minimal pain after surgery, and many bounce back quickly, but some may require a little extra care and time. We will work with you and your child to determine what they need.

Your child will have a big cup over their ear with bandages to protect the incision.

Your child will follow up with an ENT specialist about 10 days after surgery to check in on how things are healing.

CI Candidacy Evaluation

- Differences from a bilateral CI candidacy
  - MRI/Imaging
  - Pre-op testing
    - Test set-up (spatially separated)
  - Insurance – coverage for CI when patient has a “good ear”
  - Counseling and family expectations
    - Goals may be different (more than acquiring spoken language)
    - Importance of outcome measures
      - Tinnitus and localization
  - Timeline
    - Currently FDA approved for 5 years and older vs 9 months for bilateral
  - Hearing aid trial
    - May trial different types of devices (i.e., BCHD, CROS)

https://www.flickr.com/photos/cochlearamericas/49884917477/in/photostream/

Pre-op Testing

- Audiometric testing
- Speech perception of the poorer ear
  - Aided (if using device)
  - Word list in quiet with masking to the better ear
- Subjective rating of localization abilities and sound quality
  - Questionnaires
- Spatial hearing (3 conditions)
  1. Speech front, noise front
  2. Noise to better ear, speech to poorer ear
  3. Speech to better ear, noise to poorer ear

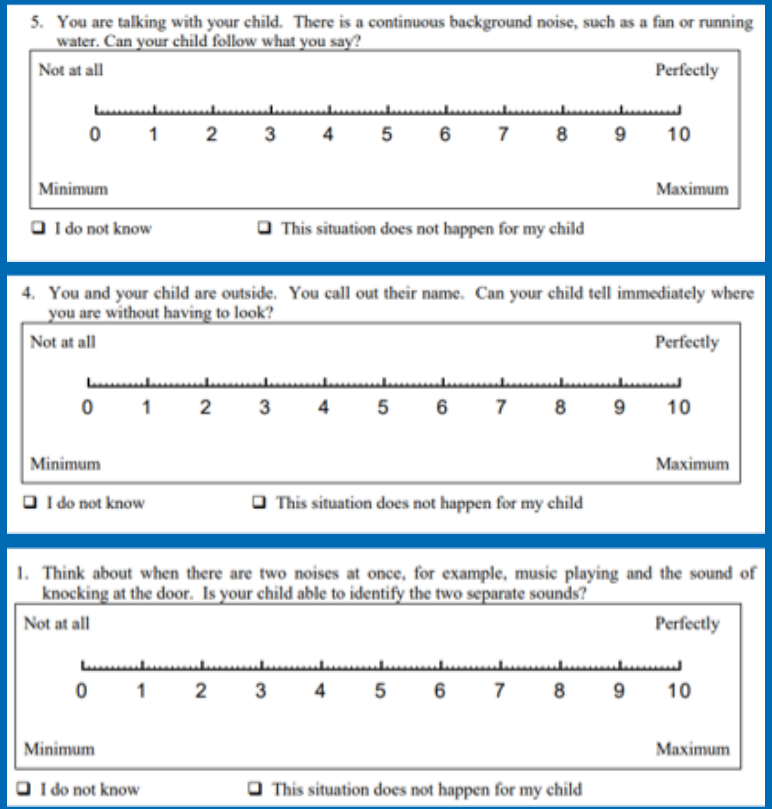
https://www.ehdi-pals.org/FamilyResources/TypesofHearingTests.aspx

- Can be completed by any managing audiologist (not just CI)

- Depending on age of child, may not be able to complete a full pre-op test battery
  - Does not exclude patient from CI candidacy

Speech, Spatial, and Qualities of Hearing Scale (SSQ)

- Designed to evaluate how a patient perceives their speech perception, spatial hearing, and qualities of hearing
- Can help determine efficacy of an intervention
- Parent, child, and teacher versions



5. You are talking with your child. There is a continuous background noise, such as a fan or running water. Can your child follow what you say?

Not at all — Perfectly

0 1 2 3 4 5 6 7 8 9 10

Minimum — Maximum

❑ I do not know ❑ This situation does not happen for my child

4. You and your child are outside. You call out their name. Can your child tell immediately where you are without having to look?

Not at all — Perfectly

0 1 2 3 4 5 6 7 8 9 10

Minimum — Maximum

❑ I do not know ❑ This situation does not happen for my child

1. Think about when there are two noises at once, for example, music playing and the sound of knocking at the door. Is your child able to identify the two separate sounds?

Not at all — Perfectly

0 1 2 3 4 5 6 7 8 9 10

Minimum — Maximum

❑ I do not know ❑ This situation does not happen for my child

HEAR-QL

- Broken into 3 categories:
  - Environments
  - Activities
  - Feelings
- 5-point scale
  - Never, Almost Never, Sometimes, Almost Always, Always
- Versions for 7-12 years & 13-18 years
  - Adolescent version includes "Family and Friends" section
- Preschool version in development

Tinnitus Questionnaires

- Tinnitus Handicap Inventory
  - 25 question to determine level of impact
- Tinnitus Functional Index
  - 25 questions
  - Divided into 8 subscales
    - Intrusive
    - Sense of Control
    - Cognitive
    - Sleep
    - Auditory
    - Relaxation
    - Quality of Life
    - Emotional
- Currently no pediatric tinnitus questionnaire

https://www.gettyimages.com/detail/photo/little-girl-covers-ears-royalty-free-image/173250583?adppopup=true

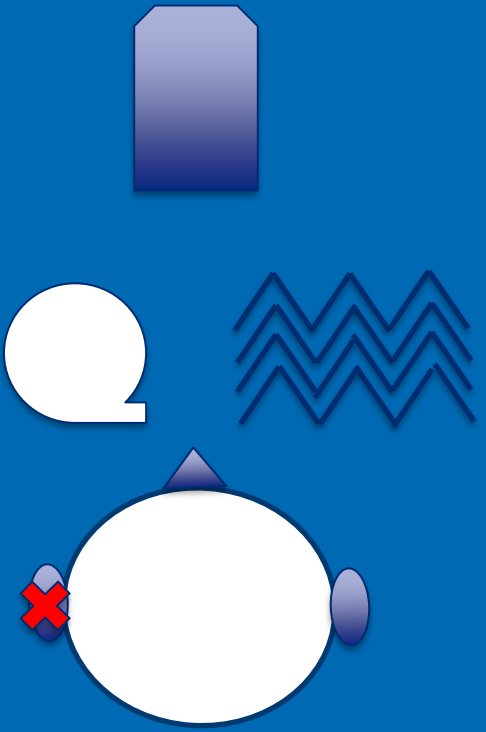
Binaural Advantages

- Binaural summation
  - The phenomenon by which listening with two ears provides a perceived increase in sound as compared to listening with one ear
- Head shadow effect
  - The mass of the head can attenuate sounds from one side to the other
- Binaural squelch
  - Using time and level differences between ears to process sounds and perceptually separate speech from noise
- Spatial release from masking
  - The phenomenon that allows listening to be easier when the noise and target signal are spatially separated

https://www.shutterstock.com/image-photo/mandalay-myanmar-burma-april-2-2019-1567957111

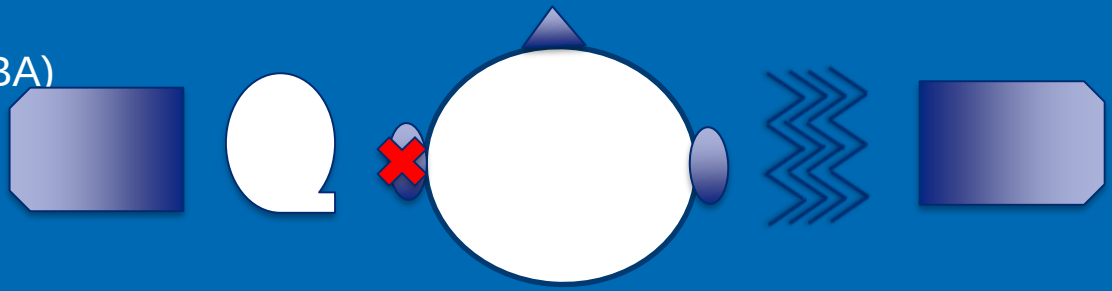
Binaural Summation

- The process by which presenting a signal to both ears results in a natural “boost” of sounds
- Speech front, noise front
- Speech at 60 dBA
- Masking level 0 dB SNR (60 dBA)



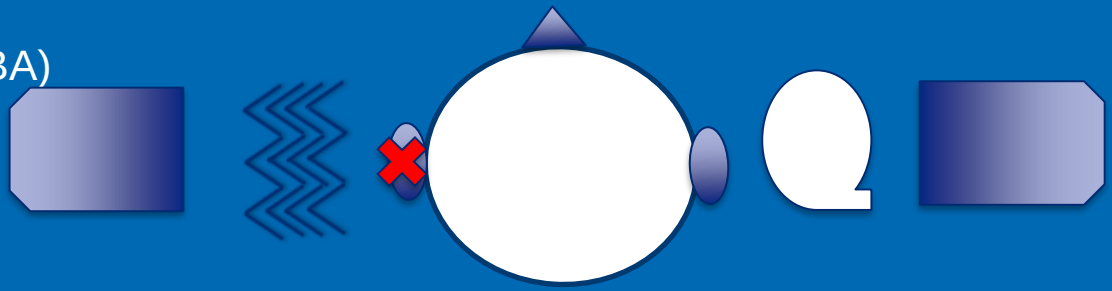
Head Shadow Effect

- Mass of the head attenuates sound presented on one side from reaching the opposite side
- Speech to poorer ear, noise to better ear
- Speech at 60 dBA
- Masking level 0 dB SNR (60 dBA)



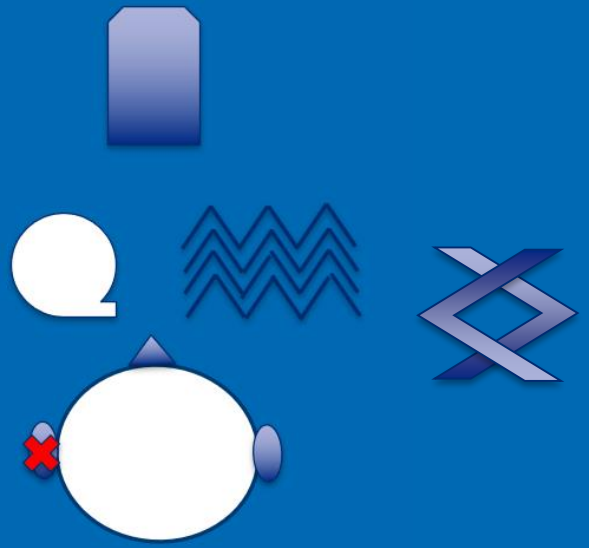
Binaural Squelch

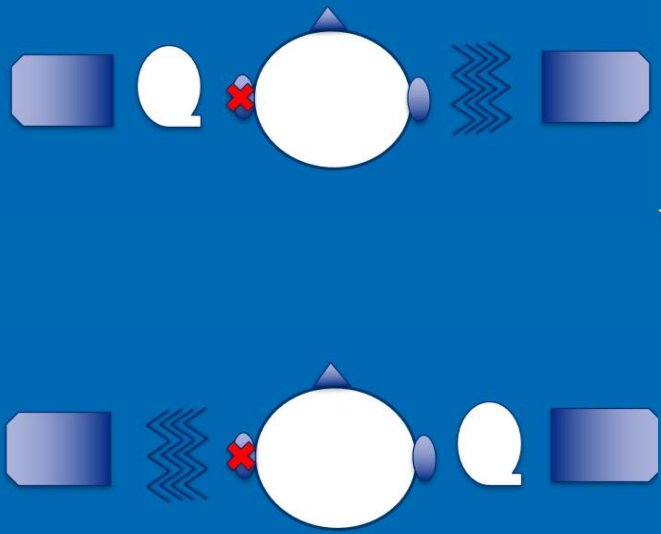
- Occurs when timing and level differences between ears provide cues that support selective listening
- Speech to better ear, noise to poorer ear
- Speech at 60 dBA
- Masking level 0 dB SNR (60 dBA)

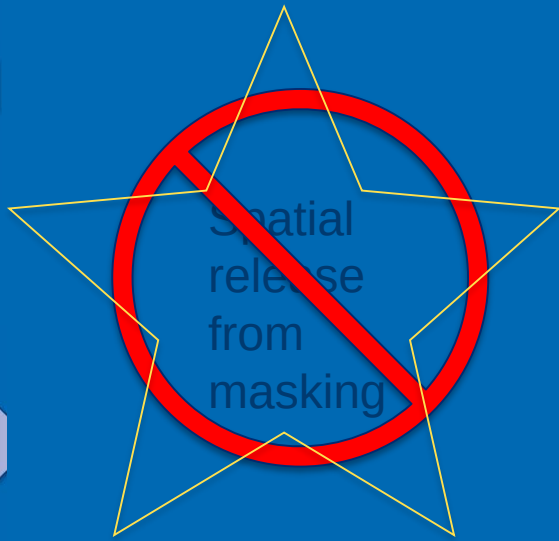


Spatial Release from Masking (SRM)

- Performance improves when speech and noise are coming from different directions as opposed to both coming from the same direction
- To determine if patient has SRM, compare scores from when speech/noise are coming from the same location versus when they are separated
    - If score from a spatially separated test (head shadow effect or binaural squelch) is better than binaural summation score → patient has spatial release from masking
- Does not require additional testing – can use test scores from previous test configurations






Spatial
release
from
masking

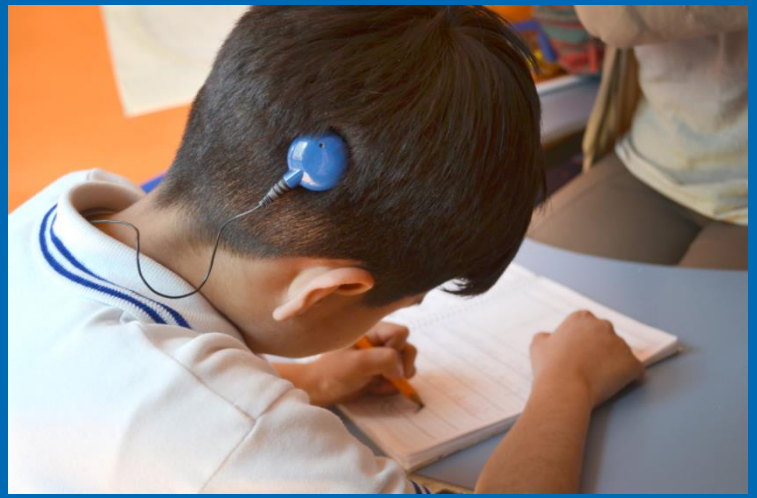
Additional Pre-Op Considerations

https://hearingloss.ca/kids-hearing/for-children-with-hearing-loss-listening-can-be-exhausting-work/

- What if my patient performs well on baseline measures?
  - Testing at more challenging SNR
- Other factors to consider:
  - Listening effort/fatigue
  - Personal motivation
  - Safety
  - Quality of life
  - Etiology of hearing loss
- Bottom line: Great that they seem to be doing well but could they be doing better?

Documentation

- Importance of showing the need for a CI over other options
    - Includes quality of life measures
- Subjective section in report to speak to challenges of listening reported by patient and family – anecdotal information
- Child may show strong scores on speech perception testing but this doesn't capture the whole picture



https://www.hearindiana.org/how-to-apply-for-social-security-benefits-on-behalf-of-a-child-with-hearing-loss/

Post-op Follow-up

- Same schedule as traditional/bilateral CI patients!
  - Activation
  - 2 weeks
  - 1 month
  - 3 months
  - 6 months
  - 9 months
  - 1 year

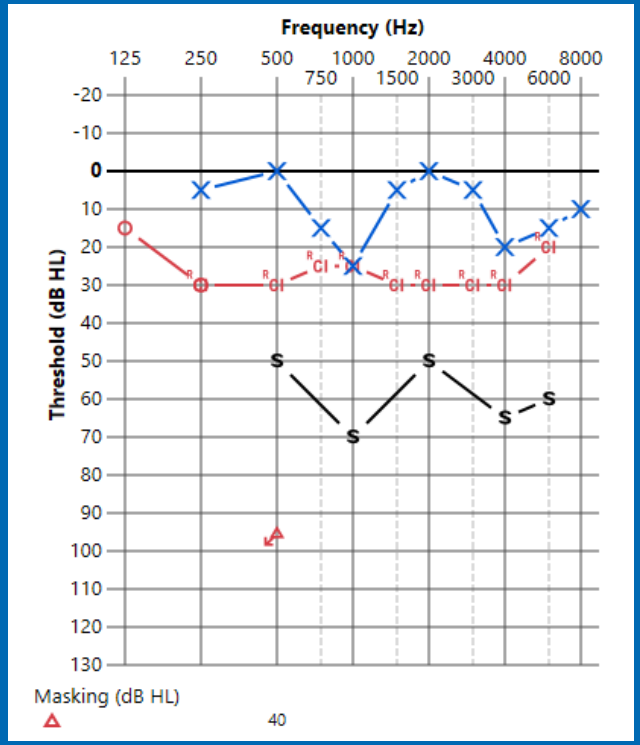
Mapping Differences

- Mute audio on fitting computer/software
- Minimize environmental sounds
    - May consider plugging/muffing the better ear
- Use of objective measures such as electrically evoked stapedial reflex threshold (eSRT) to set M or C levels to make sure they are getting enough sound
    - Underfitting might lead to delayed early progress in developing binaural skills
- Enable streaming settings to assist with aural rehabilitation

https://www.discovermagazine.com/health/the-fascinating-science-and-miracle-of-cochlear-implants-improving-access-in

Post-op Audiometric Testing

1. Test non-implanted ear
2. Soundfield aided audio
    - Non-implanted ear plugged and muffed
3. Soundfield unaided audio
    - Non-implanted ear still plugged and muffed
    - Cochlear implant off
    - If responses are 10 dB or greater from where aided responses were obtained, you know you're testing the CI as opposed to better ear



S = Left ear responses with left ear plugged and muffed. This was to ensure testing with right cochlear implant through speakers was truly evaluating the right ear.

Post-op Speech Testing

- When assessing word recognition of CI alone, use direct connect
    - Masking can be distracting for children and may impact score
    - Plug and muff may not be enough to attenuate speech input (other ear could contribute)

https://www.hear-the-world.com/images/media/downloads/stepping-into-a-new-future-with-the-first-cochlear-implant-donation-hear-the-world-foundation-01.jpg

Post-op Spatial Hearing

- Same three test configurations as pre-op testing
    - Speech front, noise front
    - Speech to CI, noise to NH ear
    - Speech to NH ear, noise to CI ear
- May use different SNR
    - As opposed to set 0 dB SNR, want to test at SNR where patient scores 50% correct
        - Use that SNR until they score >70%
- Comparing pre-op and post-op scores to determine binaural benefit
    - Lower SNR and/or higher percentage correct → Patient has binaural benefit
- Need to repeat testing without CI on a regular basis as children will improve in listening over time

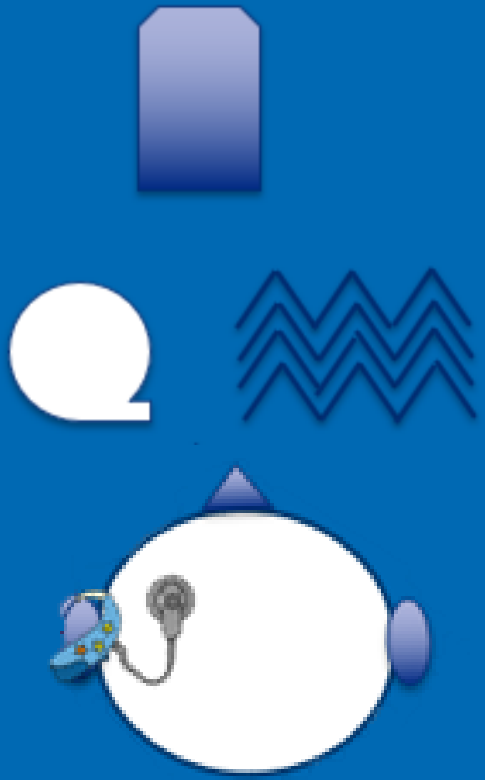
https://www.gettyimages.com/detail/photo/baby-with-cochlear-implants-having-fun-royalty-free-image/1375144747?adppopup=true

What binaural advantage are we assessing if the test set up is speech to CI ear and noise to NH ear?

1. Binaural summation
2. Binaural Squelch
3. Spatial Release from Masking
4. Head Shadow Effect

Binaural Summation

- Speech front, noise front
- Speech at 60 dBA
- Start masking level at 60 dBA (0 dB SNR)
    - If score >50%, test at a more challenging SNR
- Compare pre-op binaural summation score to post-op



Head Shadow Effect

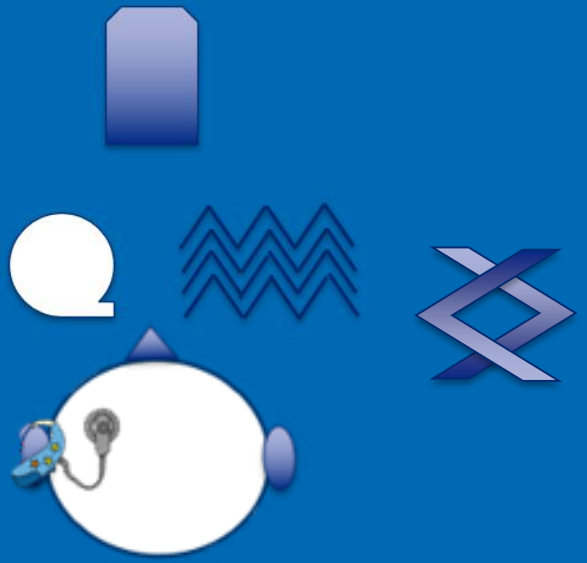
- Speech to CI ear, noise to better ear
- Speech at 60 dBA
- Masking level same as for binaural summation test configuration
- Compare pre-op head shadow score to post-op

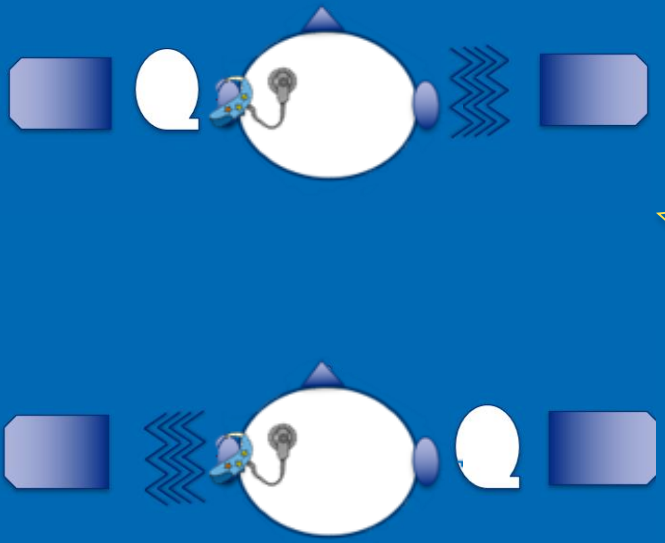
Binaural Squelch

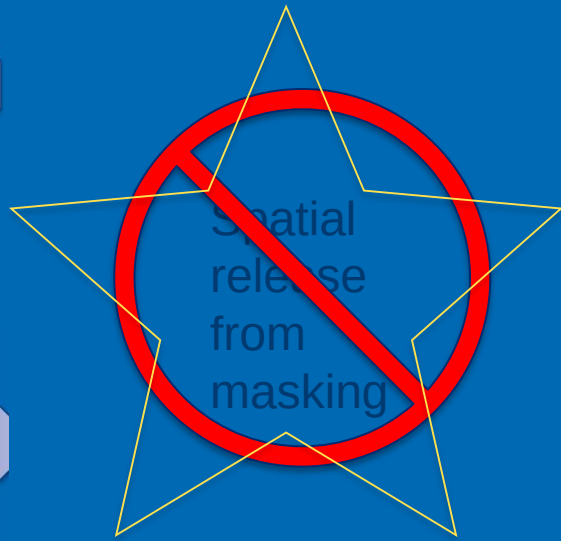
- Speech to better ear, noise to CI ear
- Speech at 60 dBA
- Masking level same as for binaural summation test configuration
- Compare pre-op binaural squelch score to post-op

Spatial Release from Masking

- Compare post-op binaural summation score to post-op head shadow effect or binaural squelch score



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release
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Summary

- While SSD CI candidates follow the same general path as bilateral candidates, there are key differences
    - Pre-op/post-op testing
    - Goals and expectations
- This is an emerging area of study and recommendations have changed over the years but ultimately research supports good outcomes for CI in children with SSD

https://www.hopkinsallchildrens.org/ACH-News/Moments/Sounds-Like-Love

References

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Galvin, K. L. & Noble, W. (2013). Adaptation of the speech, spatial, and qualities of hearing scale for use with children, parents, and teachers. Cochlear Implants Int, 14 (3), pp.135-141.

Park, L.R.; Griffin, A.M.; Sladen, D.P.; Neumann, S.; Young, N.M. American Cochlear Implant Alliance Task Force Guidelines for Clinical Assessment and Management of Cochlear Implantation in Children With Single-Sided Deafness, Ear and Hearing: March/April 2022 - Volume 43 - Issue 2 - p 255-267

Umansky, A. M., Jeffe, D. B., & Lieu, J. E. (2011). The HEAR-QL: Quality of Life Questionnaire for Children with Hearing Loss. *Journal of the American Academy of Audiology,22*(10), 644-653.

Thank you!

https://blog.medel.com/i-want-him-to-be-proud-of-his-cochlear-implants-christina-and-kais-story/

APRIL 29TH, 2022

A Multidisciplinary Approach for Cochlear Implantation in Patients with Single-Sided Deafness

Family Support Team

Children's Hospital Colorado
Here, it's different.™

Meet the Family Support Team

BILL DANIELS CENTER FOR CHILDREN'S HEARING

Audiology, Speech and Learning Family Support Services

- Communication options
- Hearing technology
- School/childcare considerations
- Resources and community connections

We are here to provide support services for families whose children have been identified with a hearing loss. Contact us to learn more about our services and to schedule an appointment via telehealth or in-person.

- Metro Denver: 720-777-6801
- Colorado Springs: 719-305-9010
- Lynne.Canales@childrenscolorado.org
- Stephanie.Olson@childrenscolorado.org
- Sara.Robinson@childrenscolorado.org

"Climbing to greater heights"

Lynne Canales, MA, is a teacher of the deaf who teaches the deaf toddler groups and works in the schools

Stephanie Olson, BA, is a family consultant who brings her perspective of growing up as deaf/hard of hearing

Sara Robinson, MA, is a speech-language pathologist and family consultant with experience growing up hard of hearing

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Then, our cochlear implant team will review your child's case to make recommendations and, if appropriate, create a plan for surgery.

Throughout your journey, you'll have access to a team of multidisciplinary specialists including audiologists, otolaryngologists, speech language specialists, teachers of the deaf/hard of hearing, social workers, child life specialists, a family resource coordinator and more.

Phase 6: Ongoing hearing support and maintenance

After surgery and implant activation, we'll continue working with you to ensure your child's level of hearing and speech is progressing.

- You'll visit our cochlear implant audiologists in our Audiology Clinic 4-6 times a year for the first year, and 1-2 times a year after that.
- Your child will see a deaf/hard of hearing therapist regularly (weekly, biweekly or monthly) beginning shortly after activation to help them make sense of sounds with their new technology.
- We'll continue to check the internal device to make sure things are working properly.

Our team will also work closely with your child's school to make sure your child's sim plants are tech ready and that your child continues to meet their developmental milestones.

Your child's external device will be replaced every 3-7 years, while the internal device may need to be replaced once or twice in a lifetime.

Our support is long-lasting and ongoing. We'll continue to offer school support, social support, emotional support and more as needed.

We have a team who offers both in-person and telehealth visits for speech and listening therapies to increase access for families across the region.

The Family's Journey

Identification/Confirmation of hearing
Early Intervention unilateral hearing loss
Typical development/challenges
Family Support
Questions/resources

Unilateral Hearing Loss Facebook group (H&V)
https://www.facebook.com/groups/HVUnilateral/

Connecting with the Family

Audiology/speech appointments

Telehealth

Support the whole child

- childcare centers
- private school
- school
- extended family

Ongoing Support

Resources

Family connections

Parent expectations

Community events

- camp, social events, workshops

Transitions

Child's community

- sports teams, worship, etc.

Accommodations

- school

Real Life Strategies

Self identity
Bonding, ownership and commitment
Retention (Hearing Users Clinic)
Recognition/acceptance of new sounds
Auditory fatigue
Social situations
Day to day life
Safety
Trial and error

Classroom Accommodations

Explanation of IEP vs 504 Accommodations-

- communication with classroom teacher
- preferential seating
- repeat info
- auditory breaks
- teaching new concepts
- use of Powerschool for assignments and changes in assignments
- advocacy
- clear communication around classroom amplification
- auditory fatigue

Family Resources

https://www.handsandvoices.org/resources/uhl-considerations/considerationsguide_uhl.pdf

https://successforkidswithhearingloss.com/unilateral-hearing-loss/

https://handsandvoices.org/resources/fostering-joy.htm

https://www.facebook.com/groups/DHHFosteringJoy/

https://m.facebook.com/groups/dhhfosteringjoyprof/

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Polling Question

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