

Auditory Enhancement for CAPD: Personal Hearing Aids (PHAs)



 EAR-Central, PLLC
Specialists in Auditory Processing

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“...Auditory processing disorders are on the continuum of functional listening disorders that are defined by the term hearing loss. ...If we are going to say that APD and hearing loss are on the same continuum, we cannot be afraid of [using] hearing aids.”

Gail Whitelaw, Ph.D. “An Evidence-Based Approach to Managing Auditory Processing Disorders in Children”
—**Audiology Online** (Aug. 2015): Part 3 of “Maximizing Outcomes for Children with Auditory Disorders”
(C. Flexer, J. Madell, & G. Whitelaw)

Since we are Gatekeepers...
Shouldn't we offer more than this?



“But, we want to see the *Wizard!*”

Personal Hearing Aid (PHA) Options

- With rare exceptions, CAPD *is essentially* a “Hearing [Listening] Deficit” (though *not* a “hearing loss.”):
effects like a “conductive pad” in the CANS.
- Basic helps for signal improvement in CAPD **align with those for peripheral hearing loss:**
 - Increased audibility, fidelity (esp. for consonants)
 - Enhanced Signal-to-Noise Ratio
 - Output limiting
 - Mitigating effects of acoustics and distance
 - Easier access to target voices (Teachers; etc.)

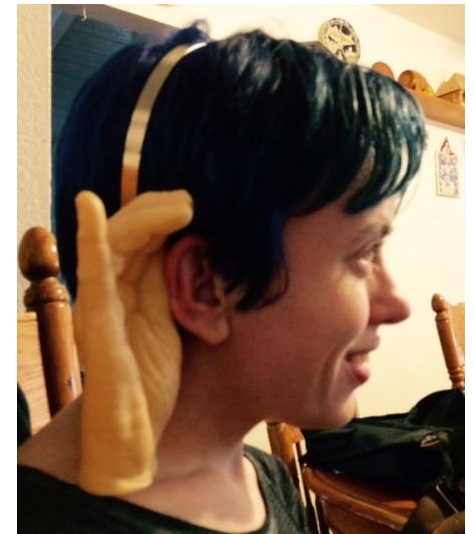
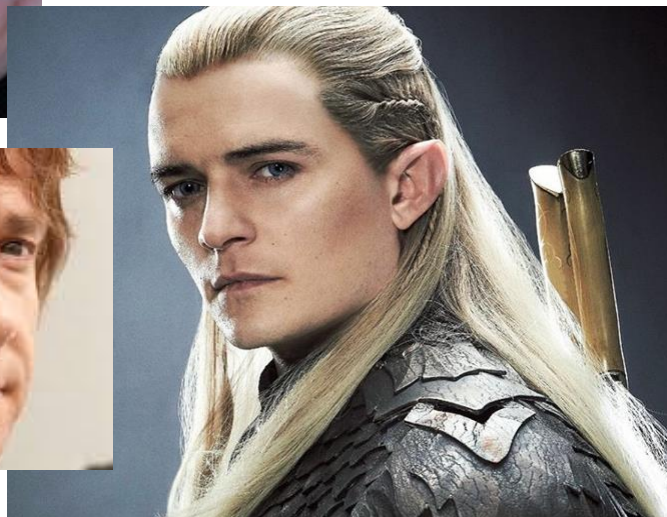
Personal Hearing Aid (PHA) Options

- I have fitted scores of Adult and Pediatric CAPD patients with PHA systems with very positive responses in most cases.
- Good outcomes for TBI. Increased “reconnection.”
- Personal Devices/Streaming/Phone Apps should be considered as a stand-alone option for auditory enhancement. (Combine with FM/DM, if needed)
- Always with a trial period! Real-Ear verification is critical!

Non-Electronic Alternatives



"Able Kids" Mold



Assistive and Therapeutic Effects of
Amplification for Auditory Processing Disorder

W. Keith & S. Purdy. Seminars in Hearing (v.35 #1), 2014.

The *immediate assistive benefits* include improved attention, learning, behavior, and participation in class, ...self-esteem and psychosocial development.

Assistive and Therapeutic Effects of Amplification for Auditory Processing Disorder

W. Keith & S. Purdy. Seminars in Hearing (v35 #1), 2014.

The *long-term therapeutic benefits* include improvements in cortical auditory evoked potential amplitudes to tone stimuli, auditory brainstem responses to speech stimuli, frequency discrimination, binaural temporal resolution, frequency pattern recognition, auditory working memory, core language, phonological awareness, and speech awareness in spatially-separated noise [LiSN-S].

**Assistive and Therapeutic Effects of
Amplification for Auditory Processing Disorder**
Wm. Keith & S. Purdy. Seminars in Hearing (v.35, #1), 2014.

...Amplification appears to treat a wide range of auditory skills simultaneously, facilitating neuroplastic change while also providing access to the auditory world. ...

Hearing Aid Considerations

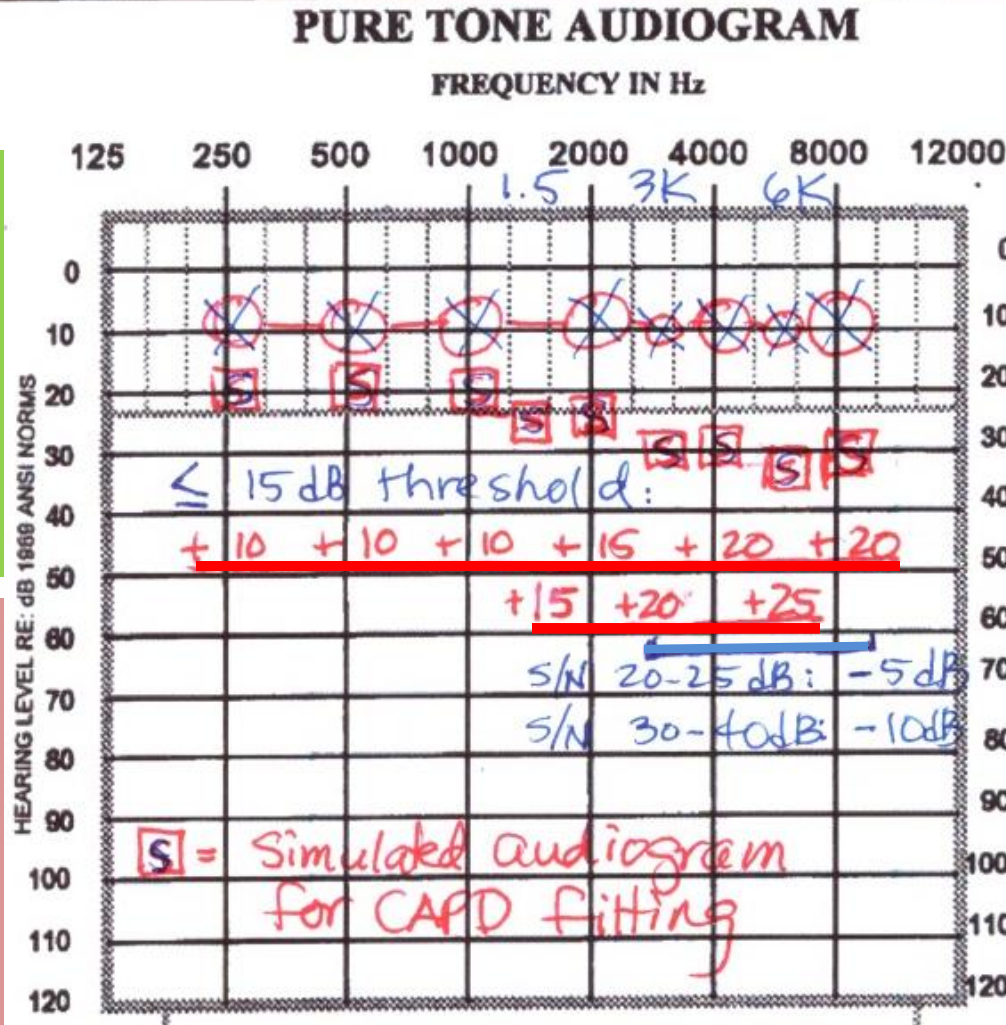
- Digital features are largely strategies to compensate for poor cochlear function. The CAPD cochlea is “normal.”
- Aggressive feedback systems aren’t critical (minimal gain)
- Multi-band processing and noise reduction systems aren’t as critical (or effective) with such narrow fitting parameters
- Complex directionality schemes / binaural “spatial sound” processing likely won’t benefit significantly. Open-ear effects.
- Sometimes complex features: multi-bands, compression factors (WDRC), noise features/switching, feedback systems; etc., introduce signal delays, circuit noise, and faint distortions (artifacts), usually not audible to cochlear hearing losses but possibly intrusive to CAPD patients. More linear is often better (think output limiting--again, think “conductive.”)

Hearing Aid Considerations (Cont'd)

But don't scrimp on the important stuff!

- Do get connectivity /companion mike capability. (FM/DM for classrooms—Roger or Edu-Mic). Phone apps helpful. Significant AD(H)D/ self-regulation issues increase need to consider FM/DM.
- If you feel a client may have access to audio-loop environments, consider a T-Coil (or at least discuss it with patient).
- I prefer to offer unlinked (independent) bi-directional VCs for the two ears (not always available). Avoid HA's with “sprinkler” VC or no VC at all.
- Pediatrics: get a good pediatric support package and warranty (L&D ins) *Smallest receivers; may need slim-tube.*

Suggested Gain Correction Factors



Flat, Reverse audiograms (>20 dB in LFs), or frequencies with A/B gaps may need extra gain (+ 5-10 dB)

+/- occluding earmolds will usually require less gain (not recommended for < 25 dB loss)
[Exc. Hyperacusis]

Simulated Audiogram should be inputted in fitting software (with a note: "Simulated for CAPD Fitting.")

Simulated Gain should be reduced in HFSNHL (3000-8000 Hz only)

General Fitting Guidelines

- I prefer a full-directional program for the default memory, especially without remote microphone.
- For kids under 7, I usually only set up one memory at the beginning, with no active controls. With more experience, add VC.
- For older kids/ adults, I will typically add an omni program as secondary, and possibly a T-program for loops or landlines (but usually not necessary)
- Experimenting with adaptive directionality may be useful in some cases, especially for group discussions.
- I usually start with a mid-level adaptation setting and, if tolerated well, increase to full target at 1st f/u appt.

General Fitting Guidelines (Cont'd)

- Acclimatization period should build ASAP to include class-time at a minimum. I encourage them to expand use to other life situations (esp. competitive), but don't demand it. Most use the HA's full time [=f(age)]
- After one month of use, provide parents/teacher(s) questionnaire(s): BMQ-R, CHAPS, Q-SAO/ CAPD-C [COSI, APHAB]
- After 3-6 months, do probe CAPD behavioral retests to gauge benefit and assist in choosing further therapeutic interventions (as needed).
- Follow-up ABR/CAEPs after 9-12 months (if applicable).

Questionnaire for Assessing Subjective Amplification Outcomes in Child CAPD Patients

(Q-SAO/ CAPD-C)

How long has your child worn personal hearing devices (PHD) to treat communication difficulties associated with central auditory processing disorder (CAPD)?

Describe **auditory symptoms** which s/he experienced prior to/ after beginning CAPD treatment with PHDs:

(Circle best option: Use different colored pens or pencils for “before” and “after” responses.)

Rating: 1-Not at all, 2-Rarely, 3-Occasional, 4-Frequently, 5-Constant/ Crisis

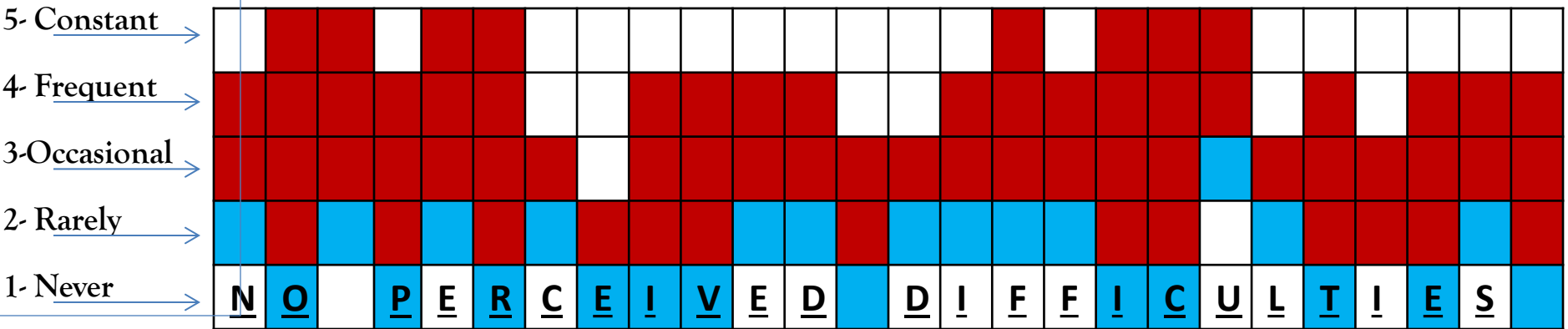
- a) Poor word recognition in quiet environments (“Huh?” a lot) [1 - 2 - 3 - 4 - 5]
- b) Poor word recognition in classes / noisy environments [1 - 2 - 3 - 4 - 5]
- c) Poor ability to maintain auditory attention [1 - 2 - 3 - 4 - 5]
- d) Poor word recognition with soft-spoken people [1 - 2 - 3 - 4 - 5]
- e) Poor word recognition from speakers/signals at a distance (> 6 feet) [1 - 2 - 3 - 4 - 5]
- f) Poor word recognition with rapid speech presentations [1 - 2 - 3 - 4 - 5]
- g) Poor word recognition with television/ Likes volume louder [1 - 2 - 3 - 4 - 5]
- h) Poor word recognition in movie theaters [1 - 2 - 3 - 4 - 5]
- i) Poor word recognition in live theater [1 - 2 - 3 - 4 - 5]
- j) If in lectures, poor understanding even with strategic/ preferential seating [1 - 2 - 3 - 4 - 5]
- k) Increased stress or anxiety in communication situations or afterwards (especially after school) [1 - 2 - 3 - 4 - 5]
- l) Increased fatigue in listening situations or afterwards (e.g., after school) [1 - 2 - 3 - 4 - 5]
- m) Poor “auditory presence” (volume/ brightness / comfortable & easy access to signals)—often signaled by complaints of “It’s not clear.” [1 - 2 - 3 - 4 - 5]
- n) Difficulty maintaining focus / attention in an extended conversation [1 - 2 - 3 - 4 - 5]
- o) Frustration felt because communication partners express impatience or frustration (teacher(s), peers, family; etc.) [1 - 2 - 3 - 4 - 5]
- p) Impaired relationship(s) attributable to partner frustration in communication [1 - 2 - 3 - 4 - 5]
- q) Difficulty when visual cues (like facial/lips) were absent or limited [1 - 2 - 3 - 4 - 5]
- r) Difficulty on the telephone (direct to ear) or when listening with one ear (e.g., monaural headset/ earbud, whisper to one side; etc.) [1 - 2 - 3 - 4 - 5]
- s) Diminished appreciation of music or reduced subjective quality [1 - 2 - 3 - 4 - 5]
- t) Difficulty understanding song lyrics [1 - 2 - 3 - 4 - 5]
- u) Negative academic progress due to auditory challenges [1 - 2 - 3 - 4 - 5]
- v) Poor linguistic processing (phonics, reading, spelling, word problems in math [1 - 2 - 3 - 4 - 5]
- w) Withdrawal from desired activities due to poor auditory performance [1 - 2 - 3 - 4 - 5]
- x) Poor confidence (anxiety) in communication situations [1 - 2 - 3 - 4 - 5]
- y) Depression related to communication struggles [1 - 2 - 3 - 4 - 5]
- z) Observable diminished self-esteem or quality of life due to auditory issues [1 - 2 - 3 - 4 - 5]

Q-SAO
/CAPD-C
(Children)

On the back of this page, please describe other significant improvements or elaborate on any impacts of PHD use which have affected your child (pos./neg.).

Q-SAO/ CAPD-C: D.M. 17-year old male. Bilat. HA (2 years)

PRE-HA
POST-HA



Word Recognition	Poor WRS in Quiet ("Huh?")	Poor WRS in Class/ Noise	Poor Auditory Attention	Poor WRS for Soft Speakers	Poor WRS for Speakers >6 ft.	Poor WRS for Rapid Speech	Poor WRS for TV/ Volume Up	Poor WRS for Movie Theater	Poor WRS for Live Theater	Poor WRS in class w/ Pref. Seats	> Comm. Stress / Anxiety	> Communication fatigue	Poor "Auditory Presence"	Difficulty w/ focus & Attn.	Hurt by Partner Frustration	Impaired Relationships	Diff. when no visual cues	Diff. on phone/ monaural	< Music Appreciation/Quality	Difficulty w/ Song Lyrics	Neg. Academic Outcomes	Poor Linguistic Processing	< Activities due to APD	Poor confidence in Comm.	Depression related to APD	< Self-Esteem due to APD
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Personal Impacts
Success
Relational Impact
Music Enjoyment
Other

Conclusions

- **Questionnaire responses, patient acceptance, and subjective observations by parents/educators/ therapists support the use of personal hearing devices (PHAs) as an effective management tool in many forms of CAPD, including cases associated with TBI.**
- **Engaged, proactive family, therapeutic and school support is a major factor in success.**
- **Use of concomitant FM/DM wireless mic options enhances class outcomes, but doesn't appear prerequisite to many of the observed benefits (Significant ADHD may increase need.)**

Conclusions (Cont'd)

- **While some PSAPs and other OTC/ internet or otherwise non-audiologically-supervised PHDs MAY provide certain benefits, the fitting of such devices to normal peripheral hearing, *especially in children* could be harmful and should be supervised by a APD-qualified audiologist, including real-ear verification of safe levels and assessment of outcomes for evidence of benefits.**
- **Annual monitoring of hearing and key CAPD test outcomes is advised.**
- **Cost of quality PHAs/ lack of insurance coverage is a major deterrent to adoption of this form of CAPD management. Unbundled pricing should be considered. CAP patients usually low maintenance.**

Conclusions (Cont'd)

- **Earlier intervention affords the potential of more robust outcomes (> neuroplasticity) AND greater acceptance/utilization of the devices, often extending beyond mere classroom use to “life.” >Use time >benefits. Cognitive deficits may limit perceived benefits.**
- **PHA stimulation often exhibits therapeutic effects (like with FM usage) beyond the mere target of signal access and clarity: binaural integration, temporal resolution, music appreciation, attention/focus, self-regulation, speech production/voice regulation.**
- **Use of PHAs may be useful as a “broad-spectrum” neuroplastic preparation to mitigate the magnitude of some CAPD deficits and reduce the number/ duration of other therapies required.**