

Management of Listening Challenges in Children with Autism Spectrum Disorder

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Agenda

1. Introduction to Autism & audiologic research in ASD
2. Intervention – wireless communication general findings
3. Transition to Clinical Practice
4. Clinical Case Studies

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Introduction to Autism Spectrum Disorder (ASD)

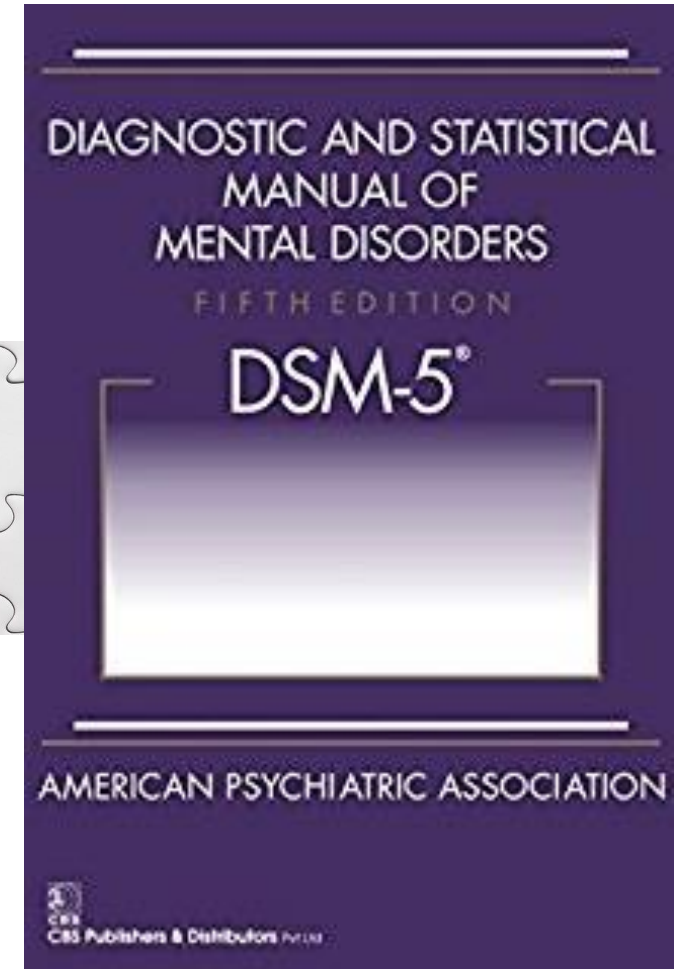
The Diagnosis of ASD

Neurodevelopmental disorder

'Spectrum' disorder

May 2013 – changes to DSM-V

Asperger Syndrome (AS) and Pervasive Developmental Disorders- Not Otherwise Specified (PDD-NOS) no longer present

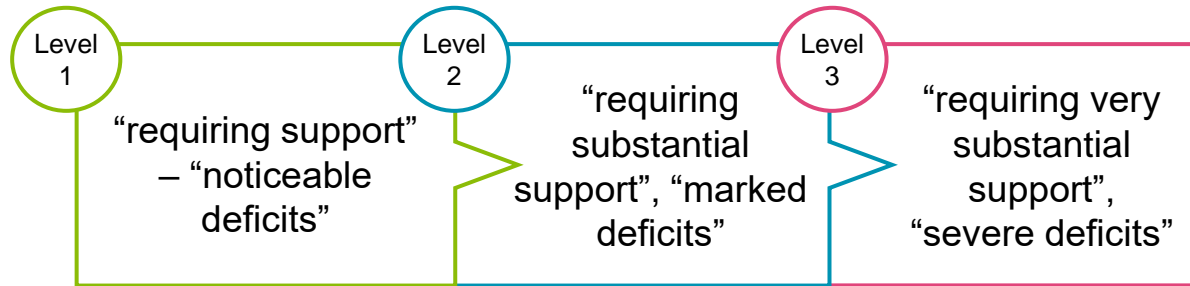


DSM-V criteria

- A Persistent deficits in social communication and social interaction across multiple contexts
 - Deficits in social-emotional reciprocity
 - Deficits in nonverbal communicative behaviors
 - Deficits in developing, maintaining, and understanding relationships
- B Restricted, repetitive patterns of behavior, interests, or activities, as manifested by at least two of the following:
 - Stereotyped or repetitive motor movements, use of objects, or speech
 - Insistence on sameness, inflexible adherence to routines, or ritualized patterns or verbal nonverbal behavior
 - Highly restricted, fixated interests that are abnormal in intensity or focus
 - **Hyper- or hyporeactivity to sensory input or unusual interests in sensory aspects of the environment**
- C Symptoms must be present in the early developmental period
- D Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning
- E These disturbances are not better explained by intellectual disability (intellectual developmental disorder) or global developmental delay. To make comorbid diagnoses of autism spectrum disorder and intellectual disability, social communication should be below that expected for general developmental level

Severity and prevalence of ASD

1 **Severity** is based on social communication impairments and restricted, repetitive patterns of behaviour



2 **High functioning vs. Low functioning autism (based on cognitive abilities)**

3 New criteria has enabled earlier formal diagnosis - clinicians are now confident in using the diagnostic criteria on younger children (Lombardo, Chakrabarti & Baron-Cohen, 2013).

4 More useful to access early intervention.

5 New criteria has increased ASD prevalence rate - 1 in every 68 children in 2014 compared to 1 in 100 in 2007 in U.S.A. (Zablotsky, 2014).

Audiology & Autism Spectrum Disorder



Sensory abnormalities

- Visual / somatosensory / olfactory
- Auditory deficits noted in the original ASD article (Kanner, 1943)



Hearing loss (impaired sound detection)

- Higher prevalence than in general population?



Processing abnormality

- Abnormal perception of auditory timing cues



Figure/ground deficit

- >50% children show speech-in-noise problems severe enough to exacerbate communication difficulties central to this disorder (Rance et al., 2014)

Audiology & Autism Spectrum Disorder

1

'Children with ASD exhibit abnormal behavioral performance on auditory processing tasks, especially in the presence of background noise' (Alcantara, et al 2004; Tomchek & Dunn, 2007; Ruttenger & Gordon, 1967; Alcantara et al 2012; Groen et al 2009)

2

'A substantial majority of children with ASD show significant deficits in visual and auditory attention that are indistinguishable from children with ADHD. Children with ASD showed greater deficits in impulsivity than ADHD or typically developing children' (Corbett & Constantine, 2006)

3

'Children with ASD have difficulty with auditory filtering - the ability to hear speech stimuli, complete tasks, and function in the presence of background noise' (Ashburner et al 2008)

4

Pattern of poorer auditory temporal disruption in individuals with ASD (Groen et al., 2009; Alcantara et al 2012; Rance, 2013)

5

Tasks involving spectro-temporal complex material (e.g., speech) and operations (attention, evaluation) that require higher order auditory processing are characteristically diminished in individuals with ASD (Samson et al 2006)

6

Auditory characteristics of children with ASD - hypersensitive or oblivious to certain sounds (Rimland & Edelson, 1994; Rosenhall et al, 1999; Stiegler & Davis, 2010)

2

**Intervention – wireless
communication general findings**

Evidence for improvement by wireless communication devices

- **Better speech recognition in noise** (Rance et al 2014; Rance et al 2017; Schafer et al 2013; Phonak - Pelosi 2013; Schafer et al., 2014)
- **Literacy and academic achievement** (Flexer et al., 2002; Johnston et al. 2009)
- **Attention and Listening skills** (Johnston et al., 2009; Rosenberg et al., 2002; DiSarno et al., 2002; Blake et al., 1991; Purdy et al., 2009; Flexer et al., 2002)
- **Cortical responses reflecting attention** (Friederichs & Friederichs, 2005 J Educational Audiology)
- Can enhance **speech perception in noise**, aid **social interaction**, and improve **educational outcomes** in children with ASD (Rance et al., 2014)
- By stimulating the auditory sense → improvement of **concentration and attention spans**, **language usage and communication**, **eye contact** and **stereotypical body movements** in children with **ASD (n=25)** (Phonak 2011)

Summary of research thus far...

PRO

- Wireless communication systems show promising benefits in children with ASD:
 - Improvement of attention & listening skills
 - Improvement of speech perception in background noise
 - Improvement educational performance

CON

- Resistance from some children – tactile sensitivities, negative attention from peers
- Small sample sizes
- Benefit varies between children and severity of disabilities
- **Only applicable in high functioning children** on the disability spectrum

Melb. Uni. pilot clinic to generate new research (Ethics approval for broad Autism study)

5

Translation to clinical practice

Clinic Set-up



Social story



Dimmed lighting



Fidget toys



Sensory toys



Rapport building



Importance of breaks



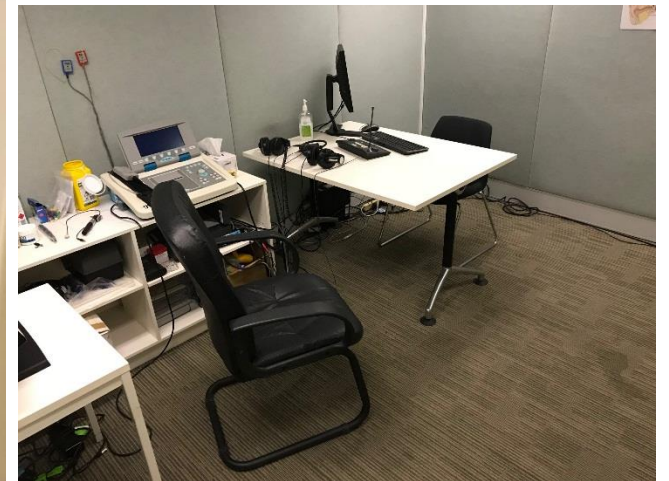
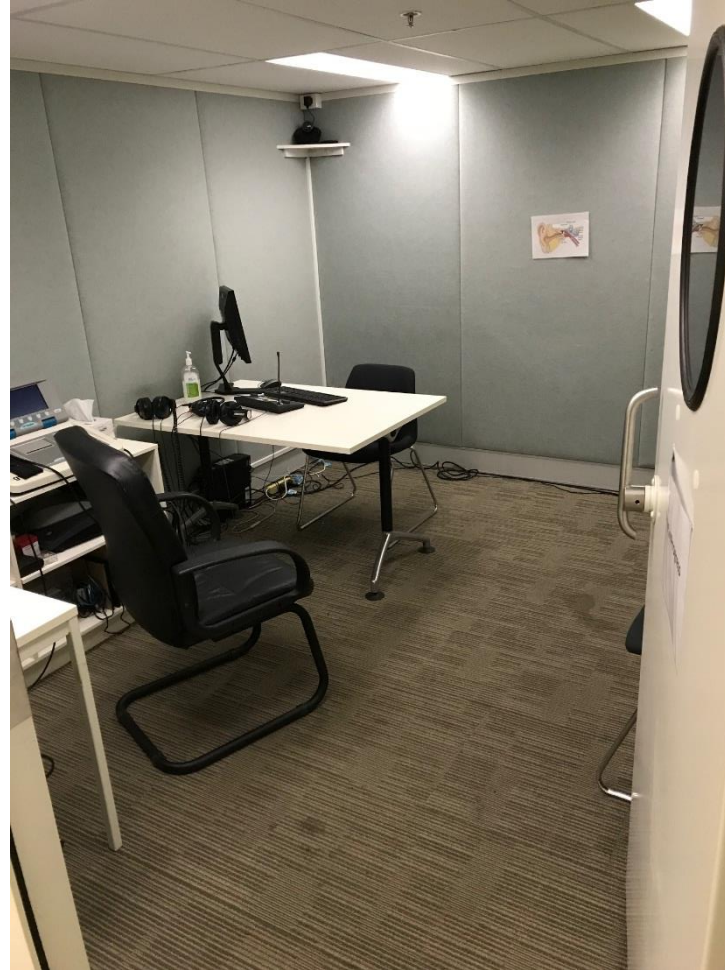
Lower expectations



Positive reinforcement, encouragement



Patience & understanding!



Clinical Protocol

- Dependent on age of child and severity of symptoms
- Inclusive of younger age-group – importance of early intervention, encouragement from referrers

Children aged 4 – 6 years (‘high functioning’)

- PTA screen, speech detection in quiet, tympanometry, Auditory Skills Assessment (ASA), reliance on caregiver & other health professional reports, stronger reliance on subjective questionnaire data

Children of any age (‘low functioning’)

- VRA, Play Audiometry or combined, tympanometry (if can), DPOAEs (if can), reliance on caregiver & other health professional reports, stronger reliance on subjective questionnaire data

Children aged 6 – 8 years (‘high functioning’)

- PTA screen, speech detection in quiet, tympanometry, LiSN-S full PGA, IVA-QS

Clinical Protocol

Children aged 8 years + (‘high functioning’)

- Full test battery over 2 separate testing sessions
 - PTA screen
 - Speech detection in quiet
 - Tympanometry (middle ear function)
 - Listening In Spatialized Noise-Sentences full PGA (LiSN-S) – spatial listening
 - Integrated Visual and Auditory attention quick screen (IVA-QS) – sustained auditory & visual attention
 - Macarena (temporal processing) – amplitude modulation detection
 - Randomised Dichotic Digits (DDT) & Dichotic Words (DWT) tests - dichotic listening
 - Profiling Elements of Prosody in Speech-Communication (PEPS-C)

Subjective analysis pre vs. post device trial (caregivers/parents)

	Data Collection Phase					
	Pre-Assessment		Pre-Trial		Post-Trial	
Respondent	Contents	Available Versions in Survey Monkey	Contents	Available Versions in Survey Monkey	Post-Trial	Available Versions in Survey Monkey
Parent (Child with High Functioning ASD below 6yo)	-----	-----	<ul style="list-style-type: none"> CHILD WHO PEACH 	<ul style="list-style-type: none"> Clinic Only Research Use 	<ul style="list-style-type: none"> CHILD WHO PEACH Roger Post-Trial Questionnaire 	<ul style="list-style-type: none"> Clinic Only Research Use
Parent (Child with High Functioning ASD)	<ul style="list-style-type: none"> Patient History Fisher's Auditory Problems Checklist 	----- (Data will be collected on-site by Pip)	<ul style="list-style-type: none"> CHILD WHO 	<ul style="list-style-type: none"> Clinic Only Research Use 	<ul style="list-style-type: none"> CHILD WHO 	<ul style="list-style-type: none"> Clinic Only Research Use
Parent (Child with Low Functioning ASD)	<ul style="list-style-type: none"> Patient History PEACH 	----- (Data will be collected on-site by Pip)	-----	<ul style="list-style-type: none"> Clinic Only Research Use 	<ul style="list-style-type: none"> PEACH Roger Post-Trial Questionnaire (including last question) WHO 	<ul style="list-style-type: none"> Clinic Only Research Use

Subjective analysis pre vs. post device trial (teacher/s & child/participant)

	Data Collection Phase					
	Pre-Assessment		Pre-Trial		Post-Trial	
Respondent	Contents	Available Versions in Survey Monkey	Contents	Available Versions in Survey Monkey	Post-Trial	Available Versions in Survey Monkey
Teacher (Child with High Functioning ASD)	-----	-----	<ul style="list-style-type: none"> LIFE-R 	<ul style="list-style-type: none"> No (Online) Consent 	<ul style="list-style-type: none"> LIFE-R 	<ul style="list-style-type: none"> No (Online) Consent
Teacher (Child with Low Functioning ASD)	-----	-----	-----	-----	-----	-----
Child with High Functioning ASD	-----	-----	<ul style="list-style-type: none"> CA-PHAP ASC-ASD LIFE-R 	<ul style="list-style-type: none"> Clinic Only Research Use 	<ul style="list-style-type: none"> CA-PHAP ASC-ASD LIFE-R Roger Post-Trial Questionnaire 	<ul style="list-style-type: none"> Clinic Only Research Use
Child with Low Functioning ASD	-----	-----	-----	-----	-----	-----
Total Number of Online (Clinic and Research) Surveys	-----	-----	-----	11	-----	9

Roger trial

Most common equipment

Roger Focus (usually monaural)

Touchscreen microphone

Roger Pen

Roger Clip-on microphone (if teacher reports neck issues)

Trial length: 6-8 weeks



Roger Touchscreen Mic



Roger Pen



Roger Clip-on-Mic

6

Clinical Case studies

Case Study 1: 'MS'

- **Background:**
- **DOB:** 18/09/2010, 7 years old
- **ASD diagnosis:** August, 2014 by Speech pathologist, Psychologist & Paediatrician
- **Comorbidities:** ADHD and anxiety
- **Medication:** Ritalin in the past. Currently taking Lovan to help with anxiety symptoms
- **Current main concerns:** impulsivity, non-compliance & poor social skills
- **Currently therapies:** speech pathology & psychology
- **Listening skills:** reported to be sporadic, dependant on the task/environment (if he is interested/comfortable, respectively), takes a lot of effort to bring back to task at hand. Instructions have to be repeated multiple times
- **Educational setting:** mainstream primary school with an education support aid in class
- **Current educational performance:** 'adequate'
- **ME history:** history of COME, grommets at 22 months

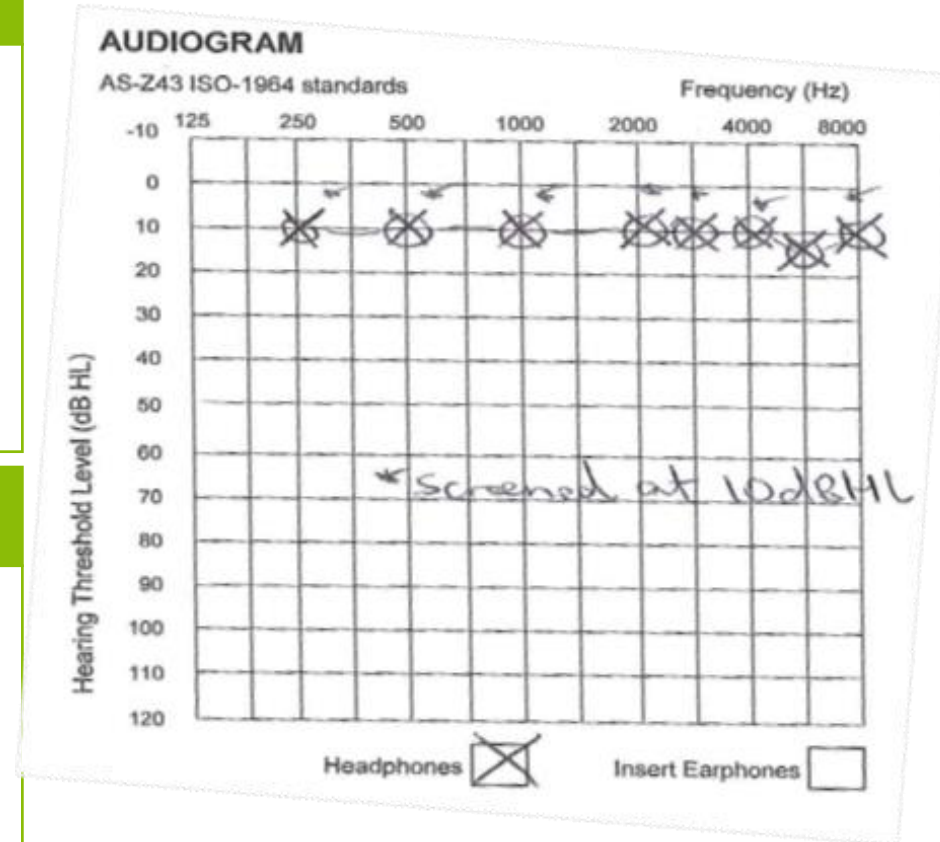
Case Study 1: 'MS'

Test results

- Audiogram: hearing sensitivity thresholds within the normal range bilaterally
- Speech detection max scores in quiet were consistent with the audiogram
- Type A tympanograms recorded bilaterally, consistent with normal middle ear compliance
- LiSN-S results – significant spatial processing disorder, also suggestion of language deficit given low + high-cue conditions are down

Trial

- 1X Roger Focus, 1X Touchscreen microphone for 8 weeks at school
- MS happy wearing the Focus – no cosmetic appeal issues or tactile sensitivities
- Teacher compliance more challenging in this case – using device and completing questionnaires

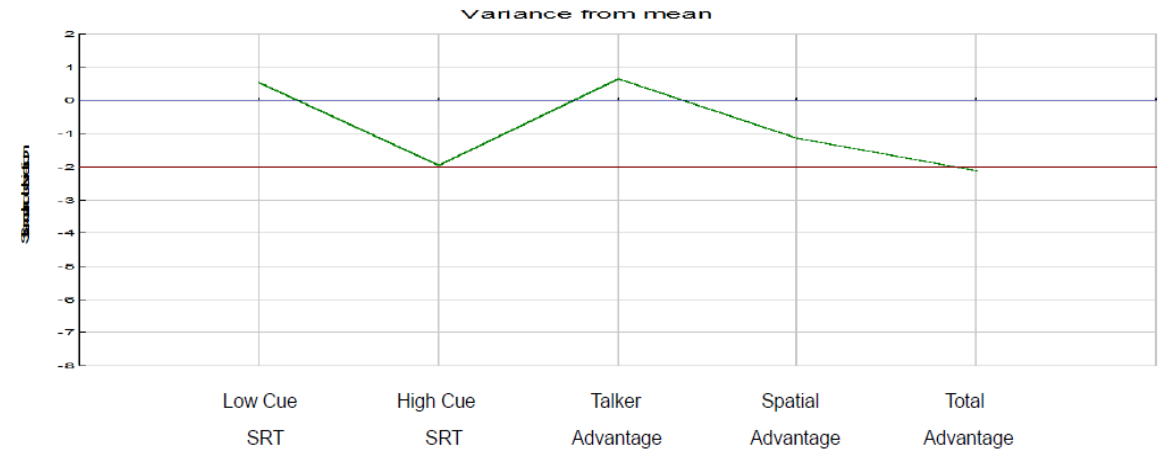
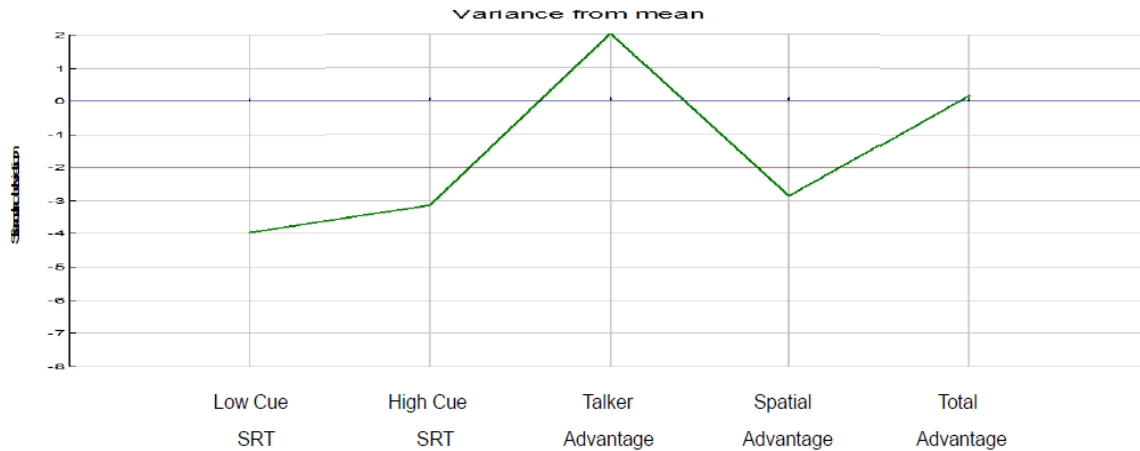


Case Study 1: 'MS'

Pre-trial vs. post-trial LiSN-S scores

Measure	Average score for age	Cut-Off Score (dB)	Client's Score (dB)	Normal limits	Variants from average in stdDev
Low-Cue SRT	-0.4	2.4	5.2	Outside	-4.0
High-Cue SRT	-13.2	-9.9	-8.0	Outside	-3.2
Talker Advantage	3.2	-1.4	7.8	Within	2.0
Spatial Advantage	11.1	7.1	5.4	Outside	-2.9
Total Advantage	12.8	9.0	13.1	Within	0.2

Measure	Average score for age	Cut-Off Score (dB)	Client's Score (dB)	Normal limits	Variants from average in stdDev
Low-Cue SRT	-0.5	2.3	-1.2	Within	0.5
High-Cue SRT	-13.3	-10.0	-10.1	Within	-2.0
Talker Advantage	3.2	-1.4	4.7	Within	0.7
Spatial Advantage	11.1	7.2	8.9	Within	-1.1
Total Advantage	12.8	9.0	8.8	Outside	-2.1



Case Study 1: 'MS'

- **Summary of questionnaire results: pre- and post-trial comparisons**
- **MS' parent's responses to questionnaires:**

Questionnaire: Children's Home Inventory for Listening Difficulties (C.H.I.L.D) – Family Member

A family-centred instrument designed to reveal the communication needs of children within the context of their home environment, and monitor how well a child is improving his or her listening skills within the home.

Note: higher scores indicate better understanding/performance i.e. the higher the score the better

Reference:

Results:

Type of situation	Pre-trial average score	Post-trial average score
Quiet	24	30
Noise	12	26
Distance	9	20
Social	7	18
Media	6	7

Case Study 1: 'MS'

MS' teacher's responses to questionnaires

Questionnaire: Listening Inventory For Education – Revised (L.I.F.E.-R.) – Teacher Appraisal of Listening Difficulty

The LIFE inventories have been a widely used efficacy and educational tool for more than 10 years. It is a valid and reliable measurement tool that can be used in a pretest and posttest format to document the effectiveness of intervention utilized to improve the classroom listening environment. This particular tool describes the student's level of challenge when listening and learning across a range of classroom listening situations.

Note: higher scores indicate less difficulty i.e. the higher the score the better

Reference:

Results:

Type of situation	Pre-trial total score	Post-trial total score
Classroom listening situations (highest score possible 75 – represents least amount of difficulty)	49	59

Case Study 2: 'CD'

- **Background:**
- **DOB:** 28/11/2007, 10 years old
- **ASD diagnosis:** 2013 by Paediatrician
- **Comorbidities:** Nil
- **Medication:** Nil
- **Current main concerns:** poor attention and focus in class and in noisy environments, poor auditory memory
- **Currently therapies:** speech pathology sessions at school focusing on spelling
- **Listening skills:** poor in class, better at home, even poorer in noisy settings
- **Educational setting:** mainstream primary school in a double classroom (50 students of two classes in the same space)
- **ME history:** COME from age 3 – 9 years. Grommets at age 3 & 6. TM perforation in left eardrum that eventually requires a skin graft

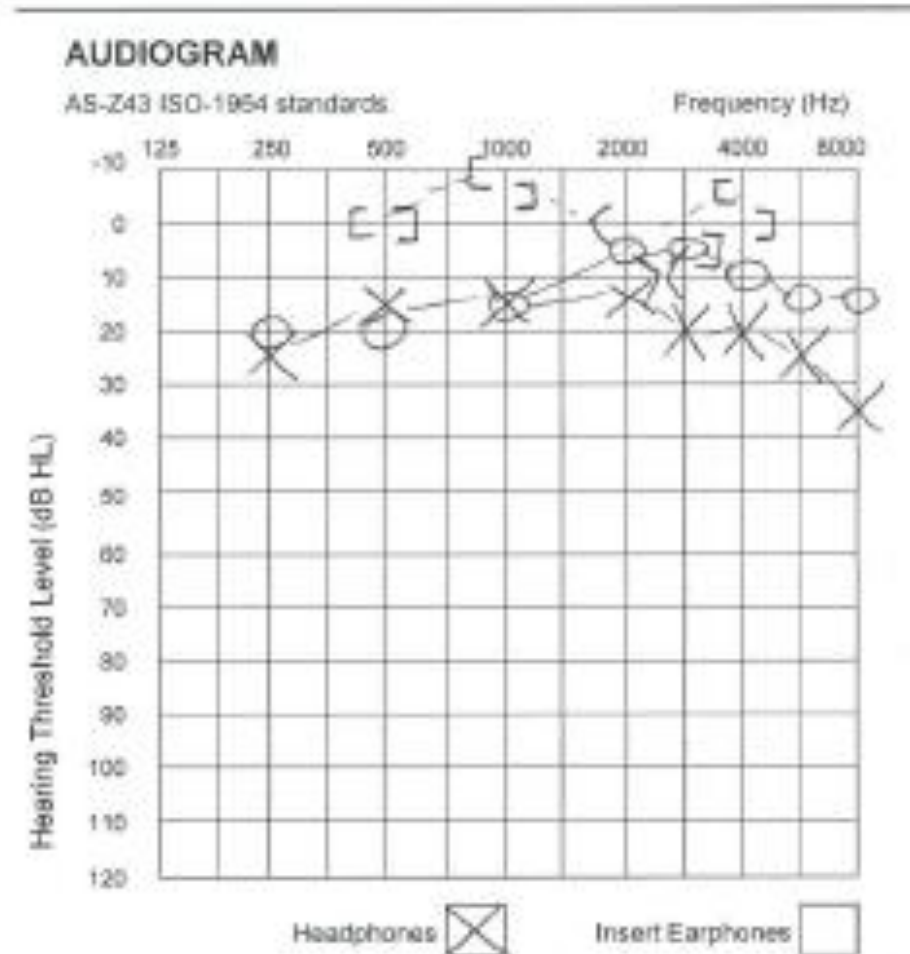
Case Study 2: 'CD'

Test results

- Audiogram: thresholds essentially within the normal range on the right side (conductive gap), mild conductive loss on left side
- Type B high vol. tympanogram recorded on the left side, consistent with a TM perforation
- Type C tympanogram recorded on the right side, consistent with significant Eustachian Tube dysfunction
- Speech detection max scores consistent with audiogram

Trial

- CD trialled 2X Roger Focus paired to a Roger Touchscreen microphone for 8 weeks at school & in social environments/group activities
- CD very positive first reaction - no cosmetic appeal issues or tactile sensitivities

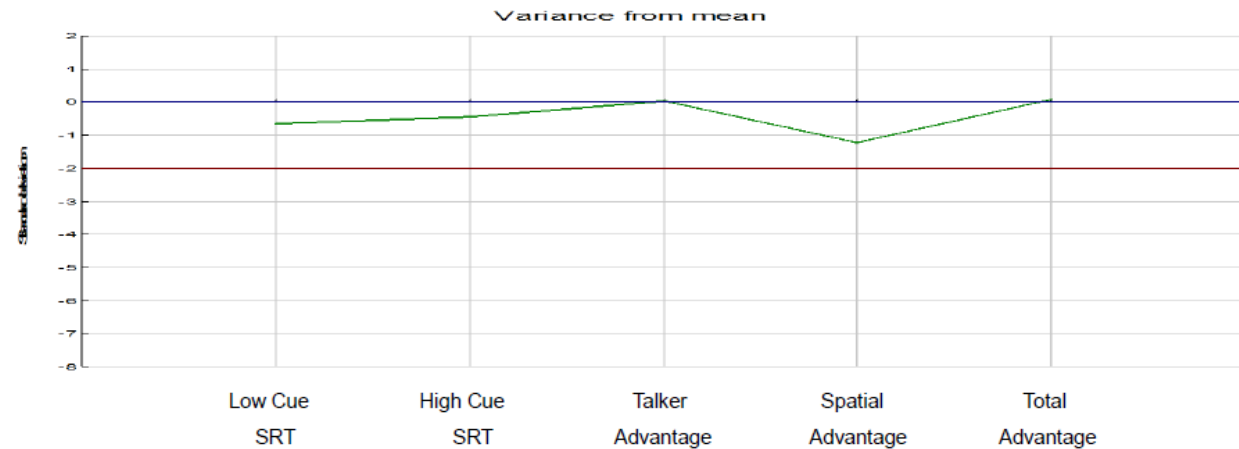
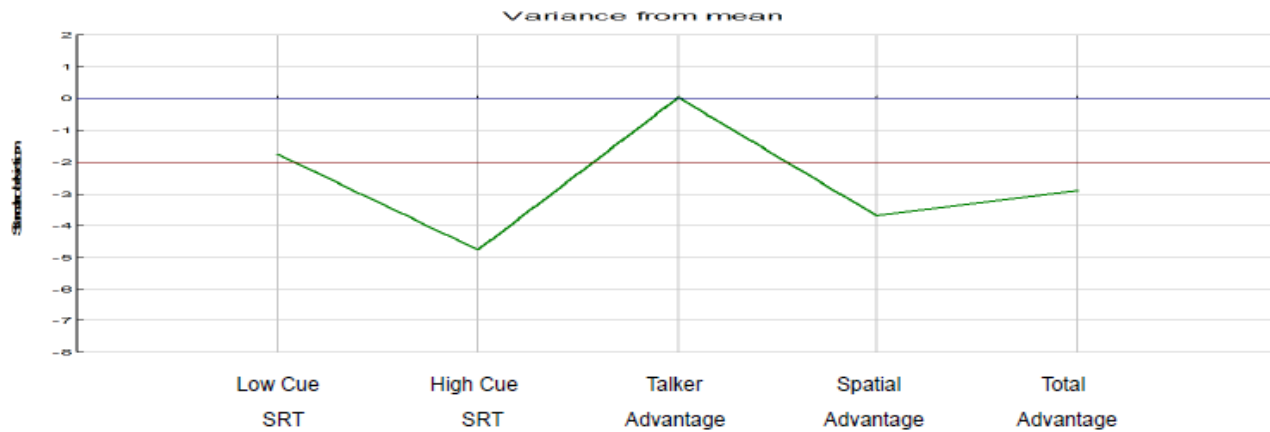


Case Study 1: 'CD'

Pre-trial vs. post-trial LiSN-S scores

Measure	Average score for age	Cut-Off Score (dB)	Client's Score (dB)	Normal limits	Variants from average in stdDev
Low-Cue SRT	-1.1	1.7	1.4	Within	-1.8
High-Cue SRT	-14.7	-11.4	-6.8	Outside	-4.8
Talker Advantage	4.0	-0.6	4.1	Within	0.0
Spatial Advantage	12.1	8.2	4.8	Outside	-3.7
Total Advantage	13.7	9.9	8.2	Outside	-2.9

Measure	Average score for age	Cut-Off Score (dB)	Client's Score (dB)	Normal limits	Variants from average in stdDev
Low-Cue SRT	-1.1	1.7	-0.2	Within	-0.7
High-Cue SRT	-14.8	-11.5	-14.0	Within	-0.4
Talker Advantage	4.0	-0.6	4.1	Within	0.0
Spatial Advantage	12.2	8.2	9.8	Within	-1.2
Total Advantage	13.7	9.9	13.9	Within	0.1



Significant improvement in CD's post-trial LiSN-S results

Case Study 1: 'CD'

Pre-trial vs. post-trial IVA-QS scores

Measure	Pre-trial	Post-trial
Auditory Response Control	78 – mildly – mod impaired	32 – extremely impaired
Auditory Attention	27 – extremely impaired	11 – extremely impaired
Auditory Sustained Attention	0 – extremely impaired	0 – extremely impaired
Visual Response Control	Invalid	Invalid
Visual Attention	Invalid	Invalid
Visual Sustained Attention	Invalid	Invalid

- CD highly compliant, well behaved and interested in his results
- Visual responses congruent with behavioural optometry observation of challenges with rapid number calling, eye tracking, visual capture & visualisation auditory analysis

Case Study 3: 'CD' Trial feedback

- “We had a little play with the Roger on the train and at home yesterday and it was like magic ! We will meet with [CD's] teacher hopefully this week to give her instruction and get it in the classroom ASAP”
- Philipa hi today was the first day using the listening device and [CD] said it made a "Massive Difference". Thanks for this opportunity”



“Hi Philippa, today Cy told a friend of mine that he feels like he is fitting in better at school because of the Phonak! 😍😍

Case Study 3: 'CD' Trial feedback

June
WEEK 22

April 2018					May 2018					June 2018						
M	30	2	9	16	23	M	7	14	21	28	M	4	11	18	25	
T		3	10	17	24	T	1	8	15	22	T	5	12	19	26	
W		4	11	18	25	W	2	9	16	23	W	6	13	20	27	
T		5	12	19	26	T	3	10	17	24	T	7	14	21	28	
F		6	13	20	27	F	4	11	18	25	F	1	8	15	22	29
S		7	14	21	28	S	5	12	19	26	S	2	9	16	23	30
S	1	8	15	22	29	S	6	13	20	27	S	3	10	17	24	

Friday 15/2/13

00 am

30

10

0

Mac had an amazing week, after 2 weeks away sick. He coped with Mrs Jones being away Mon-Weds, including having a relief teacher (Mrs Singh) on the Tue. He did all of his work tasks and the week went without incident. Mrs Payda (his aide), has noted increased engagement and eye contact, and decrease in resistant behaviours. He wrote 16x "sh" words (eg. shop), leaving time to write daddy his first personal letter - this is huge, because prior to his sick leave writing even one word was a challenge.

This week is the first week of Mac wearing his "super sonic hearers". There is little doubt that they have prompted an awakening of his will to engage in the world around him.

Clinical tips to take away

- Schedule more time for appointment/s
- Ask for reports from other health professionals – create a broad picture
- Create a social story and/or send photos/detailed information on what clinic looks like, what is involved etc.
- Environmental modifications where possible – dimmer lighting, plenty of fidget toys
- Introduce yourself and explain what you do and what is going to happen in the session – be organised and try (where can) to stick to an ordered plan
- Be calm, friendly and literal, use child's interest areas to build conversation and rapport
- Go beyond the audiogram – include speech perception-in-noise test at the very least

Thank you for listening

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we change lives**