

Pediatric Audiometry

Workshop: Herbstversammlung der SGORL,
15. – 16. November 2018

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- The audiogram, base for pediatric hearing aid fitting
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- Pediatric hearing aid fitting objectives
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- Types of hearing systems
- Compliance
- Fitting, tests and wear time
- Empowerment of child and parents, follow up, repairs
- Discussion



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h ö r b e r a t u n g

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Introduction



Challenges in the field of pediatric audiometry

Timing

- Hearing is important for the development of the child from day one.

Partner

- Collaboration with ORL, ORL-MPAs (expertise) audio pedagogues, speech therapists and teachers is important

Relatives

- It is a new situation for the child and the whole family and friends.
- They are our partner in the hearing aid fitting process.



Medical issues

- Medical diagnosis are not complete.
- In young children development of the auditory system is still possible.
- The middle ear component can change.
- The Cooperation of the child varies.

Regulatory

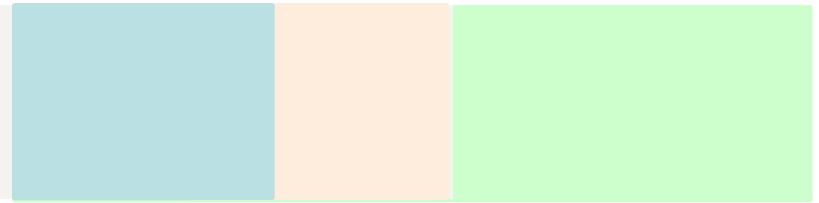
- Legal regulations in Switzerland.
- Financial limitations

The audiogram, base for pediatric hearing aid fitting

Use of the hearing test procedures: Depending on the developmental age of child

Type of investigation	Developmental age in years						
	0	1	2	3	4	5	6
Otoacoustic emissions							
Impedance measurement							
Auditorial evoked potentials							
Reflex audiometry							
Behavioural audiometry							
Play audiometry							
Tone audiometry							
Speech audiometry							
Super-threshold audiometry							

The audiogramm, base for pediatric hearing aid fitting

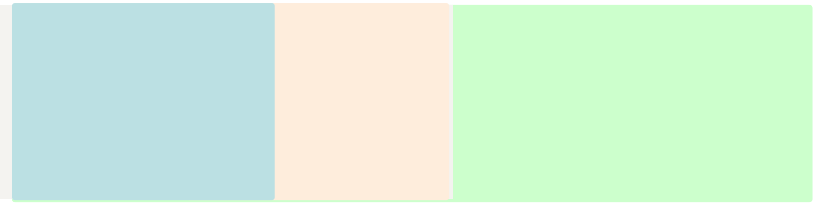


Subjective hearing tests: Reaction thresholds

The older the child, the closer the reaction threshold is to the hearing threshold.

Age of child	Reaction threshold to acoustic stimuli
Newborn	~80 dB in free field
4 Monate	~60 dB in free field
6 Monate	~40-50 dB in free field
1 Jahr	~30-40 dB in free field
3 Jahre	~20 dB via air conduction
4 Jahre	~10 dB via air conduction

The audiogramm, base for pediatric hearing aid fitting



Subjective hearing tests: Play audiometry conditioning

Audiometry conditioning variants:

- **Variation 1:** Child is conditioned to the coupling of "tone just heard and execution of a play action".
- **Variation 2:** The child is conditioned to the coupling "Sound is no longer heard and execution of a play action". (detect mild hearing disorders)
- **Variation 3:** Child is conditioned to "toy is picked up at the beginning of the tone, put down at the end of the tone". (detect moderate to severe hearing disorders)

Source: M.Kompis

Spiegeltonometrie Variante 3





Pediatric hearing aid fitting in Switzerland

- **Legal Regulation 831.201.26 from July 2011**
- **Regulations of formation and further education of pediatric audiologists**
- **Regulations of the room and equipments**
- **Regulations of financial support from the health care**
- **Regulations of the fitting process and fitting objectives**

Pediatric hearing aid fitting objectives

Severity of hearing loss and development age of the child	Pediatric hearing aid fitting objectives
<ul style="list-style-type: none">• Severe to profound hearing loss in young children• Moderate hearing loss• Slightly severe and unilateral hearing impairment	<ul style="list-style-type: none">• Hearing initiation, maybe step on the way to a CI• Optimum hearing of the environment and quiet speech components with good tolerance of loud signals. The normal development of the child and his or her speaking abilities are in focus.• Regular hearing tests. The advantages and disadvantages of hearing aid fitting must be discussed and weighed up individually.




Pediatric hearing aid fitting objectives

Severity of Hearing loss and development age of the child	Solutions
<ul style="list-style-type: none">• Severe to profound hearing loss in young children:• Moderate hearing loss:• Slightly severe and unilateral hearing impairment:	   

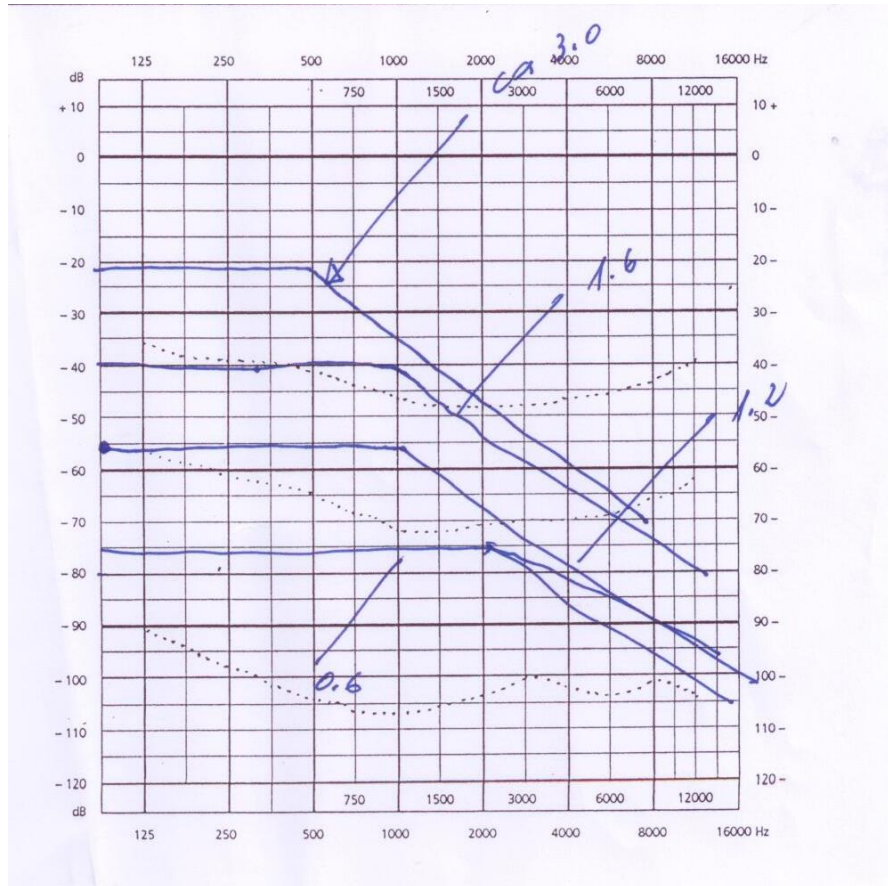
Pediatric hearing aid fitting objectives

Steps	
<ul style="list-style-type: none">• Preparation• First meeting• Hearing aid fitting• Success control• Aftercare	<ul style="list-style-type: none">• Based on the ENT findings, suggest a hearing aid.• Anamnesis, ear inspection, ear impression, information, selection of the hearing aid.• Presetting the hearing aid based on audiometric data with a fitting rule that takes into account the age of the child and the individual transfer data of the outer ear (RECD measurement, in situ measurement) (DSL v.5 or NAL-NL1 and 2).• Verification of adjustment and validation of fitting• Hearing aid service, controls

Ear impression and ear mold

Impression and ear mold	Criteria for the ear mold
<ul style="list-style-type: none">▪ Ear impression  <ul style="list-style-type: none">▪ Ear mold:<ul style="list-style-type: none">• Material• Shape• Colour• Ornament• Venting  	<ul style="list-style-type: none">▪ Children have short auditory canals.▪ Moulding until second buckling of the auditory canal▪ Acrylic (hard), silicone (soft), Thermotec (soft in heat), gold-plated▪ Bowl, ring, claw, clasp, plug (angle, hose pulled through)▪ The higher the hearing loss, the denser the plastic must be.

Ear mold, vented for a BTE System



Venting for a BTE system in dependence of hearing loss
Source: Marco Parodi

Compliance

Parents of hearing impaired children are parents in the same way as parents of non-disabled children.

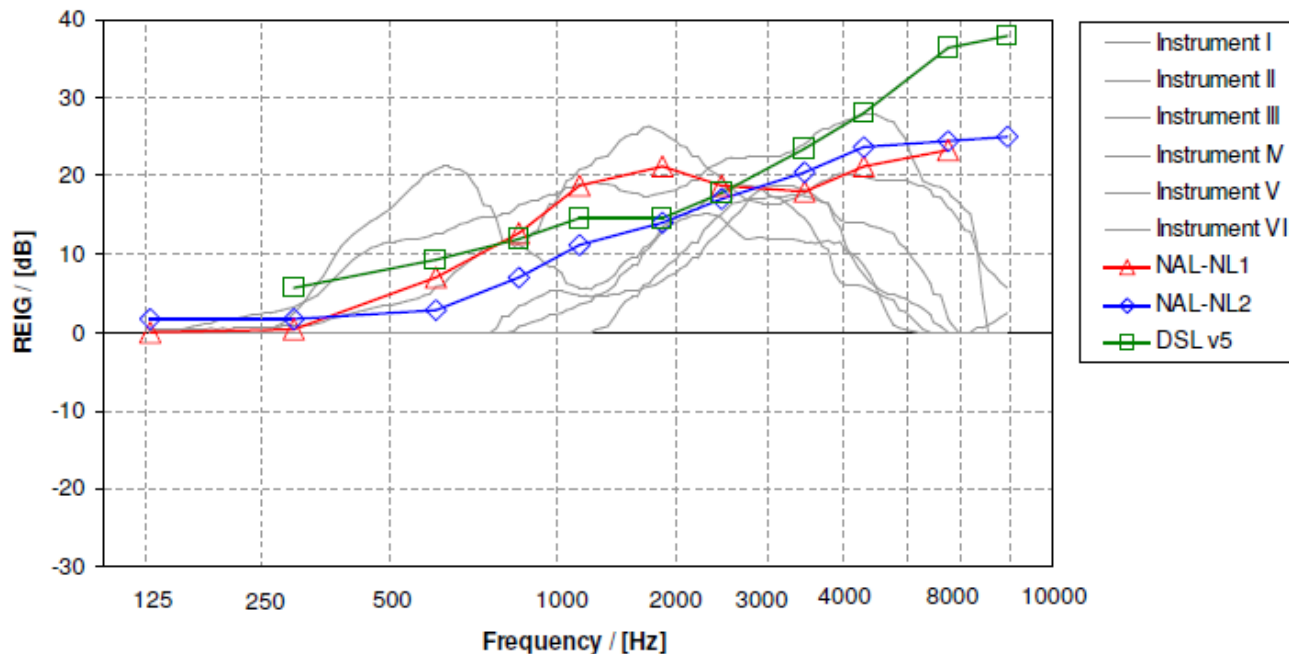


Fitting, tests and wear time

Fitting formula

FirstFit: Vergleich der Hörgerätehersteller

Frequency Responses for commercially available Hearing Aids after FirstFit
for Audiogramm ISDMADHA 2
(KEMAR, ISTS Noise, $L_I=65$ dB)



DSL v5
(DSL i/o)(National
Hearing Center for
Audiology, Canada)

NAL NL1 and 2 (National
Acoustic Laboratory in
Australia)

manufacturer algorithm
(Source: Chalupper
2011, Siemens)

Fitting, tests, wear time

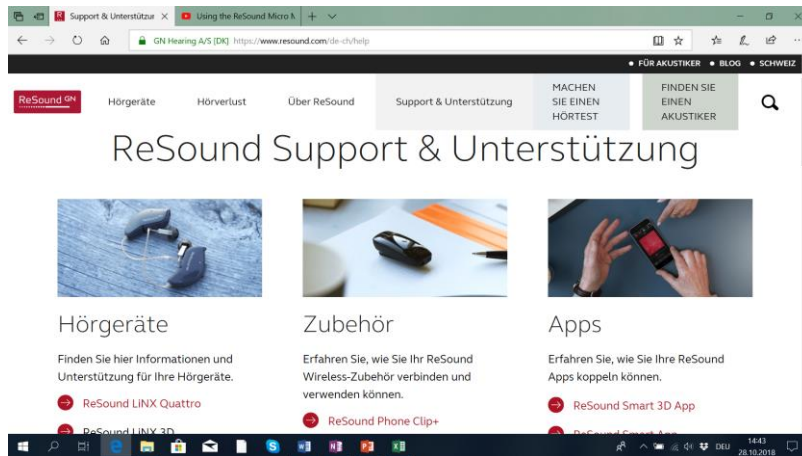
Adaption

- Exact instruction of the accompanying persons.
The hearing aid is worn for two to four hours a day during the first few weeks.
- The increase in wearing time depends on acceptance.
The technical and audiometric measurements are supplemented by everyday observations (for at least 4 weeks).
- Questionnaires Application of the 5 Loud Test according to LING: The sounds a, i, u, sch, and s cover the frequency range of the phonemes well. With the Stethoclip you can listen to the hearing aid with these sounds.
Children over the age of 3 can say the sounds or clap their hands accordingly.



Empowerment of child and parents, follow up, repairs

- Regular controls of hearing, hearing aid and fit of the ear mold
- Every 2 – 3 months service on the hearing aid (servicepass for parents and child)
- Sending in of the hearing system for repair



Discussion

- Try
- Discussion
- Questions



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