SPAU332
Hearing Aids I

Dina Budeiri MSc

Hearing instrument fine tuning and trouble-shooting & Special fitting considerations

Learning objectives: Systematically fine-tune and troubleshoot hearing aid fittings while prioritising the patient's listening needs and optimal speech understanding.

Recognizing the problem

Systematic approach

Simplify the concern

Determine the direction of change needed

Identify the controls to make the desired change

Recognizing the problem

- Five fitting problems
  - Gain by frequency including problems with low/mid/high frequency gain
  - Problems with overall gain/maximum output
  - Problems with physical fit
  - Problems with compression characteristics
  - Unwanted sounds including distortion and feedback

Jenstad, L. M., Van Tasell, D. J., & Ewert, C. (2003). Hearing aid troubleshooting based on patients' descriptions. *Journal of the American Academy of Audiology*, *14*(7), 347-360.

Recognizing the problem

- Common descriptors
  - Too loud
  - Booming
  - Can’t hear well in noise
  - Sounds like talking in a barrel

Examples of sounds commonly associated with complaints

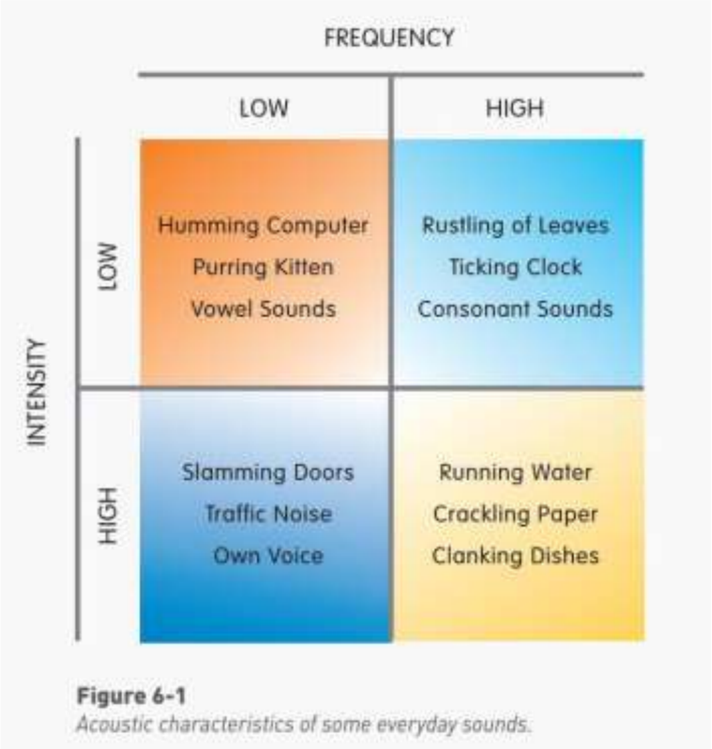


Figure 6-1
Acoustic characteristics of some everyday sounds.

https://starkeypro.com/pdfs/The_Compression_Handbook.pdf

Occlusion effect

- Patient description
  - Hollow, boomy, echoes, like speaking in a barrel, like having a cold
- Possible solutions?

Occlusion effect

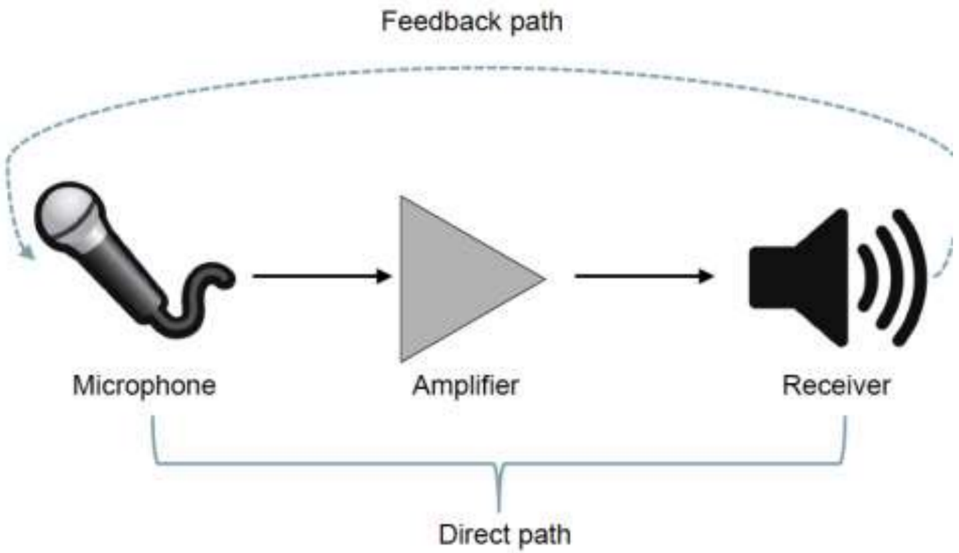
- Extending ear mould past the second bend (acoustic seal area) significantly reduces occlusion effect

- Venting
  - Low frequency sound energy can escape
  - 2 mm or more
  - Not a solution for more severe losses as low frequency gain needed for audibility
  - Will not work with many custom fittings

Occlusion effect

- Maybe related to over-amplification of low frequencies (not occlusion effect)
- Possible solutions?
  - Reduce low frequency gain
- Possible problems?
  - Audibility

Feedback



Feedback

- Volume control cannot be increased to desired level without whistling
- Whistling occurs whenever patient chews, talks, wears a hat, puts hand near ear
- Hearing aid makes ringing noise whenever certain sounds occur
- Hearing aid whistles when person is in a quiet place but stops when noise occurs

Feedback

- Sound is leaking from the ear canal to the microphone via some path
- Solutions?
  - Examine ear for partial occlusion
  - Run feedback manager –what difference does this make to hearing aid settings?
  - Remake ear mould
  - Change to more occluding dome

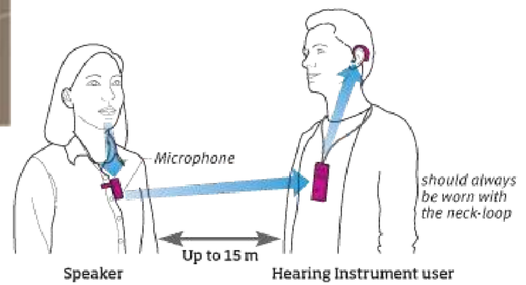
Sounds are too loud

- What situations are too loud?
  - Related to soft, medium or loud sounds?
- Solutions?
  - Check they don't have loudness discomfort without hearing aids
  - Lower the MPO
  - Adjust gain for loud sounds (increase compression ratio)
  - Lower overall gain

Problems understanding speech in noise

- Expectations for speech understanding reasonable?
- What goals were identified by COSI or other tool?
- Was speech testing completed before fitting?
- Is volume control being used appropriately?
- Is directional program being used appropriately?
- Is patient positioning themselves and communication partner appropriately?

Problems understanding speech in noise



- Hearing tactics
- Directional microphone program
- Remote microphone

Problems understanding on the telephone

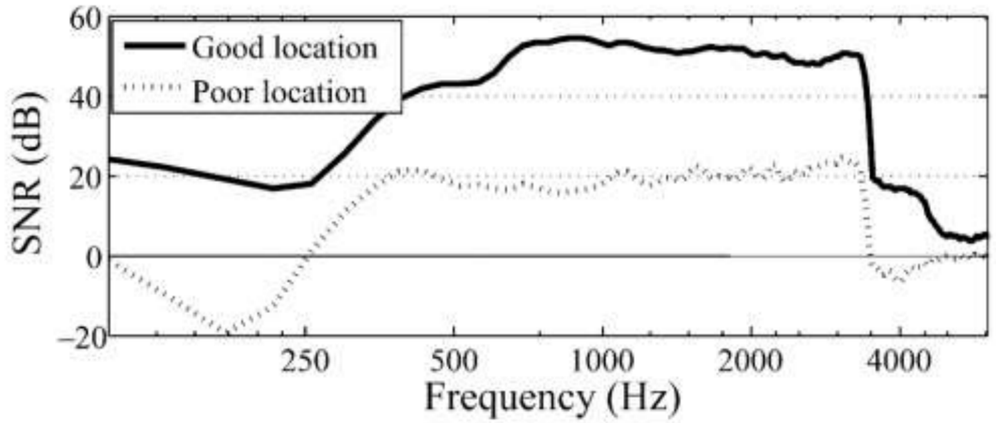


Figure 6. Example SNRs for two participants, one who was more successful at telephone receiver placement ('Good Location') and another who was less successful at telephone receiver placement ('Poor Location').

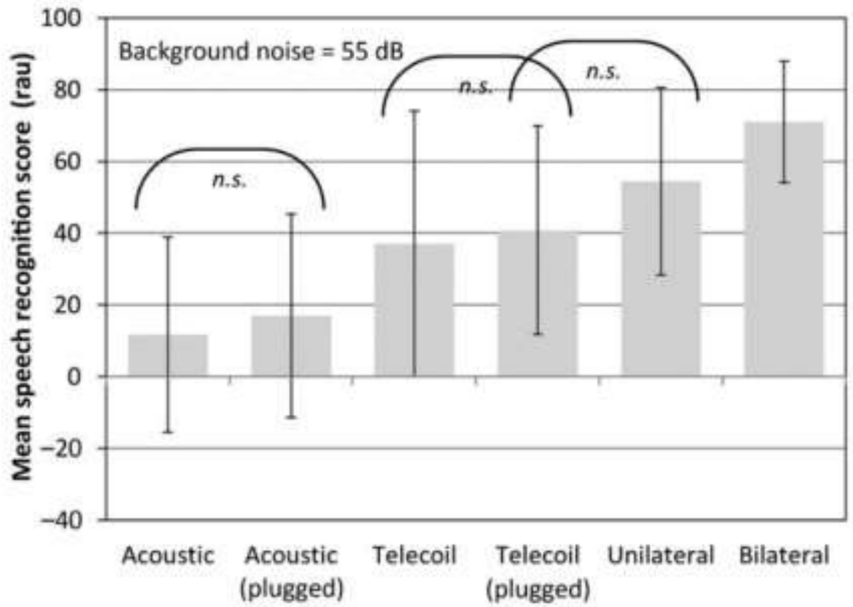
Picou, E. M., & Ricketts, T. A. (2013). Efficacy of hearing-aid based telephone strategies for listeners with moderate-to-severehearing loss.*Journal of the American Academy of Audiology*,*24*(1), 59-70.

Problems understanding on the telephone

- Solutions?
  - Counsel re telephone placement
  - New telephone
    - https://www.connevans.co.uk/
    - https://www.actiononhearingloss.org.uk/shop/shop-help/order-your-free-copy-of-our-catalogue/

Problems understanding on the telephone

- Solutions?
  - Telecoil
  - Streaming



Picou, E. M., & Ricketts, T. A. (2013). Efficacy of hearing-aid based telephone strategies for listeners with moderate-to-severe

Management difficulties

- Inserting an ear mould or thin tube dome
- Locating or using a control
- Removing a hearing aid
- Changing the battery
- Cleaning hearing aid/mould

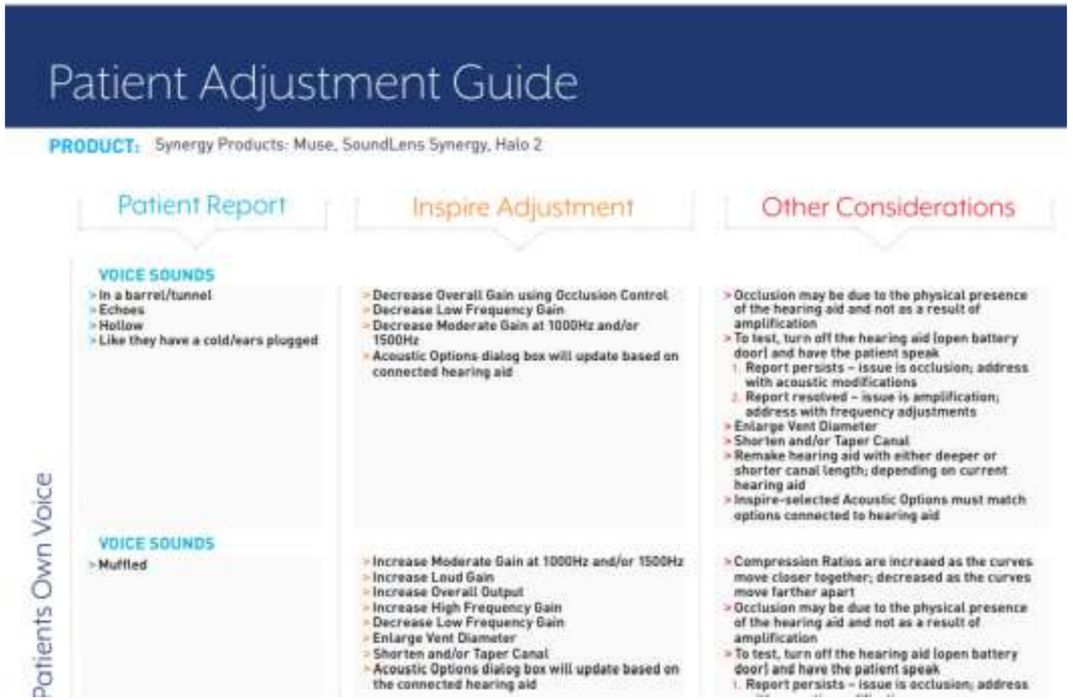
Coupling system problems

- Ear mould discomfort
- Poor ear mould or open fit dome retention

Approach

- Talk to the patient until you understand the problem
- Identify the controls and the direction of change needed
- Consult with your patient to ensure action taken has improved situation

Approach



Patient Adjustment Guide

PRODUCT: Synergy Products: Muse, SoundLens Synergy, Halo 2

Patients Own Voice

Patient Report	Inspire Adjustment	Other Considerations
VOICE SOUNDS > In a barrel/tunnel > Echoes > Hollow > Like they have a cold/ears plugged	> Decrease Overall Gain using Occlusion Control > Decrease Low Frequency Gain > Decrease Moderate Gain at 1000Hz and/or 1500Hz > Acoustic Options dialog box will update based on connected hearing aid	> Occlusion may be due to the physical presence of the hearing aid and not as a result of amplification > To test, turn off the hearing aid (open battery door) and have the patient speak 1. Report persists – issue is occlusion; address with acoustic modifications 2. Report resolved – issue is amplification; address with frequency adjustments > Enlarge Vent Diameter > Shorten and/or Taper Canal > Remake hearing aid with either deeper or shorter canal length; depending on current hearing aid > Inspire-selected Acoustic Options must match options connected to hearing aid
VOICE SOUNDS > Muffled	> Increase Moderate Gain at 1000Hz and/or 1500Hz > Increase Loud Gain > Increase Overall Output > Increase High Frequency Gain > Decrease Low Frequency Gain > Enlarge Vent Diameter > Shorten and/or Taper Canal > Acoustic Options dialog box will update based on the connected hearing aid	> Compression Ratios are increaed as the curves move closer together; decreased as the curves move farther apart > Occlusion may be due to the physical presence of the hearing aid and not as a result of amplification > To test, turn off the hearing aid (open battery door) and have the patient speak 1. Report persists – issue is occlusion; address

Frequency-lowering technologies

- Original speech signal

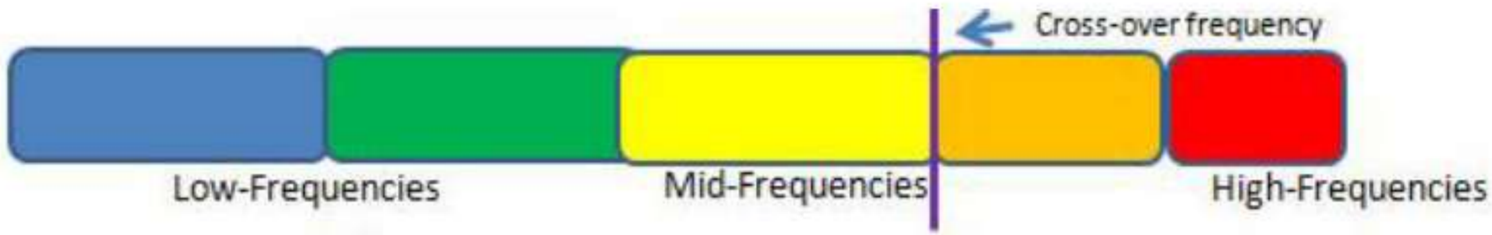
http://www.agbell.org/ParentGuideHA.aspx

Frequency-lowering technologies

- Linear frequency transposition
  - Takes high-frequency sounds and moves them into a lower frequency range
  - High-frequency and low-frequency sounds are overlaid

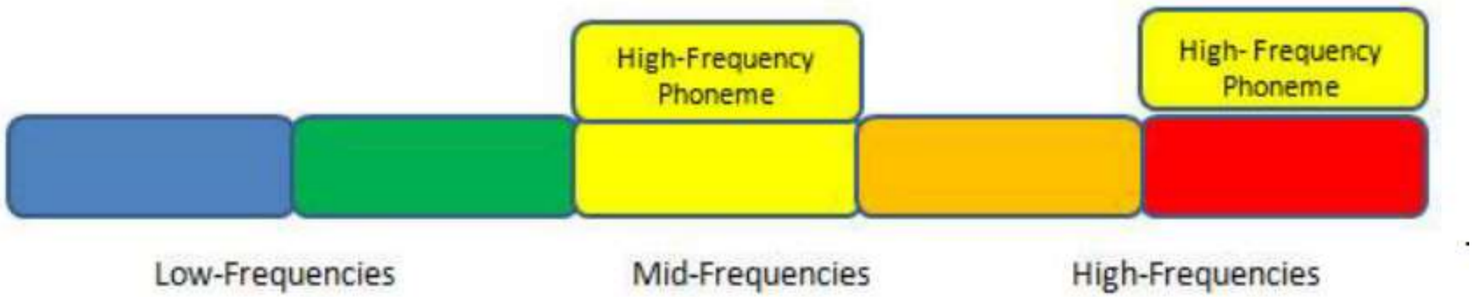
Frequency-lowering technologies

- Non-linear frequency compression
  - Takes high-frequency information above a designated frequency range and compresses it into a lower range
  - High and low-frequency sounds are not mixed
  - High-frequency information is altered



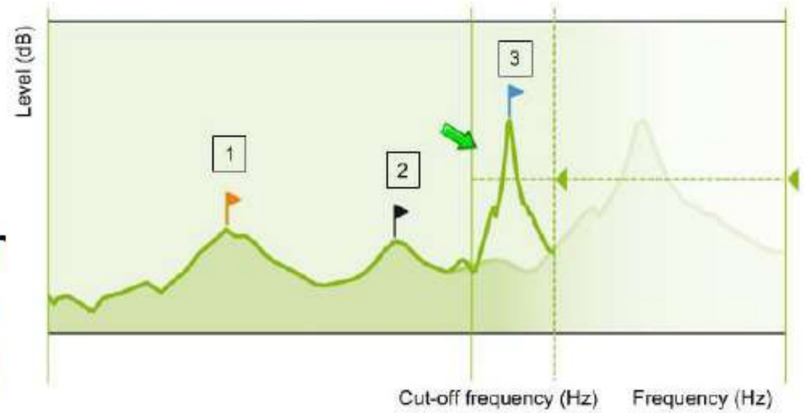
Frequency-lowering technologies

- Spectral envelope warping
  - Captures high-frequency information and replicates it at a lower frequency
  - High-frequency and low-frequency sounds are overlaid
  - High frequency sound is not altered



Frequency-lowering technologies

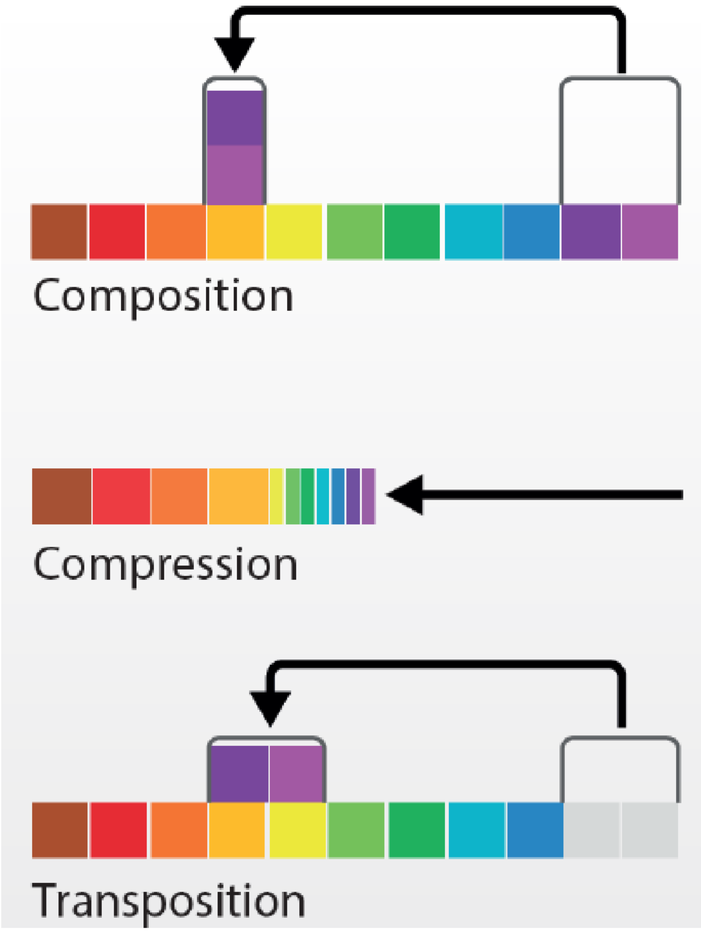
- SoundRecover (Phonak)
  - Non-linear frequency compression
  - Inputs above cut-off frequency will be compressed
  - Frequency compressior is applied in increasing strength to higher input frequencies



https://www.audiologyonline.com/interviews/introducing-phonak-sky-v-226-16883

Frequency-lowering technologies

- Speech Rescue (Oticon)
- Frequency composition
  - Superimposes high-frequency source band on a low-frequency destination band
  - Leaves output bandwidth intact



https://www.audiologyonline.com/ask-the-experts/does-speech-rescue-frequency-lowering-15901

Frequency-lowering technologies

- Recent systematic review
  - Some improvements in speech intelligibility
  - Modest benefits
  - Benefits not seen across all measures
  - No detrimental effects

Andrea Simpson, Alicia Bond, Michelle Loeliger & Sandy Clarke (2017): Speech intelligibility benefits of frequency-lowering algorithms in adult hearing aid users: a systematic review and meta-analysis, International Journal of Audiology, https://doi.org/10.1080/14992027.2017.137516