To Patch or Not to Patch

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Topics

1. What is Patching?
2. Advantages of Patching
3. Potential Issues with Patching
4. Should you patch?

What is “patching”? (when used with assistive listening technologies in the classroom)

In the general sense:
To connect by a **temporary** electrical, radio, or telephonic connection. (*Wikipedia*)

In the classroom:
To connect a personal remote microphone (RM) transmitter (e.g. *Inspiro*) via an audio cable to the classroom’s existing sound field speaker, in order for a student with hearing aid(s) or cochlear implant(s) to hear the teacher via his/her personal RM receivers.

Teacher wears
microphone for sound field

inspiro
audio
in port

Sound field
speaker's audio out

PATCHING

Student hears
teacher in personal
receiver

As opposed to “worn-direct”:

Advantages of Patching

1. The classroom's existing sound field system can be used.

2. The teacher wears only one microphone.

3. Hard of hearing student hears the teacher in his/her personal remote microphone receiver(s).

Potential Issues with Patching

Compromised signal for the hard of hearing student due to:

1. Signal degradation due to impedance mismatch

2. Loss of adaptive speech over noise engineering (e.g. *Dynamic FM*)

3. Signal verification and monitoring issues

Evidence #1 of Signal Degradation from Patching: *Internal study by Christine Joe & Carrie Siu*

- Summer 2012
- Objective: To investigate whether and how patching changes the performance of personal FM systems at the personal receiver level
- Equipment: Inspiro, EasyLink+, MIxi receiver, Micro Nios hearing aid, Lightspeed Red Cat
- Performance was measured and compared based on:
  - Electro-acoustic measurements using the Audioscan RM500SL
  - Sound quality via stethoscope coupled to hearing aid and receiver
  - Speech recognition in noise tests

(1) Summary of Results – Electro-acoustic Performance

→ Average frequency responses in the patched condition were 3-7 dB BELOW that in the worn-direct condition.

→ The only scenario when the overall output matches (within 1 dB) that in the worn-direct condition was when the Inspiro Audio setting was set to “iPod Nano” and the “Audio Out” on the Red Cat set to “Max”.

(2) Summary of Results – Sound Quality

→ Sound quality in the patched condition was subjectively judged as comparable to that of the worn-direct condition in ONLY ONE scenario, i.e. when the Inspiro Audio setting was at “iPod Nano”, Red Cat audio out set to “Max”, AND the Red Cat **lapel** mic was used.

→ In the remaining 10 scenarios, sound quality was judged as inferior to the worn-direct condition due to the presence of a background hum, distorted consonants, or audible breathing noise.

(3) Summary of Results – Speech Recognition in Noise

→ The number of correct key words in a sentence repetition test was scored in the patched and worn-direct conditions.

→ Difference in performance between the patched and worn-direct conditions was NOT clinically significant.

→ Comparable performance likely due to optimum audio settings.

Conclusion from Joe & Siu (2012) study:

It is ok to patch AS LONG AS
all the technical settings
(i.e. audio in/out parameters)
are set correctly based on
extensive empirical testing.

When these settings are not available,
PLEASE do not patch!

Evidence #2 on Signal Degradation from Patching: Joint Manufacturers' Study on Patching (2009)

Auditory Management Services

(headed by Carolyn Edwards, Ed.Aud), Oticon, Phonak, Front Row & Supportive Hearing Services

- Objectives:
  - To evaluate and verify the outcome of connecting personal FM to different sound field FM and infrared systems
  - Determine optimal settings for PFM and sound field when patching is required

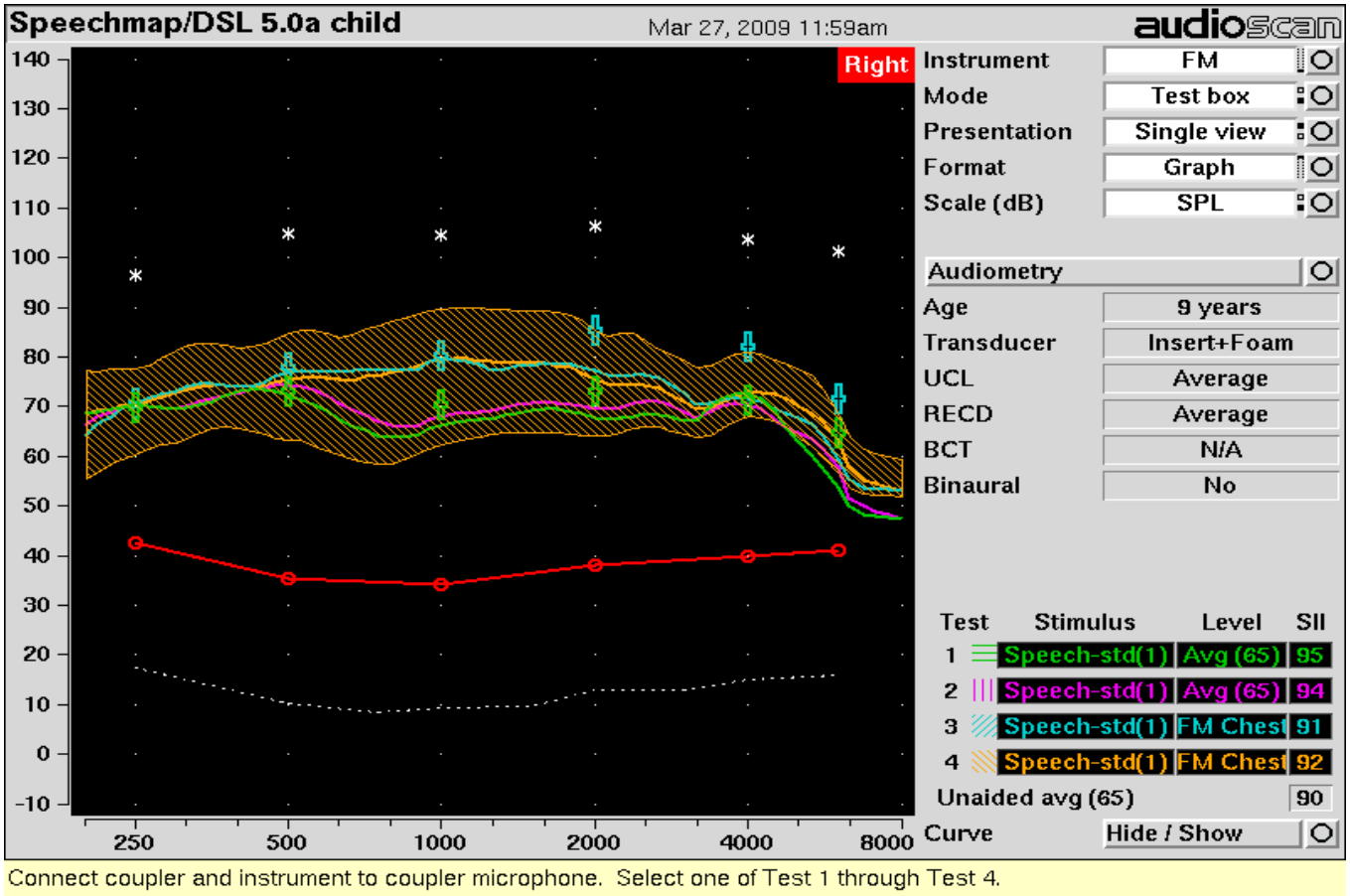
Equipment Tested:

- Personal FM
  - Oticon Amigo T20 Transmitter & R1 receiver
  - Phonak Inspiro & Campus Sx Transmitters, Mlxi receivers
- Sound Field
  - Front Row To Go SFM; Front Row Pro Digital Infrared
  - Supportive Hearing 500W SFM; Supportive Hearing 966 SFM
  - Lightspeed Red Cat Infrared
- Hearing Aid
  - Oticon Tego Pro with FM 8 audio shoe was used.

“Better” Scenario

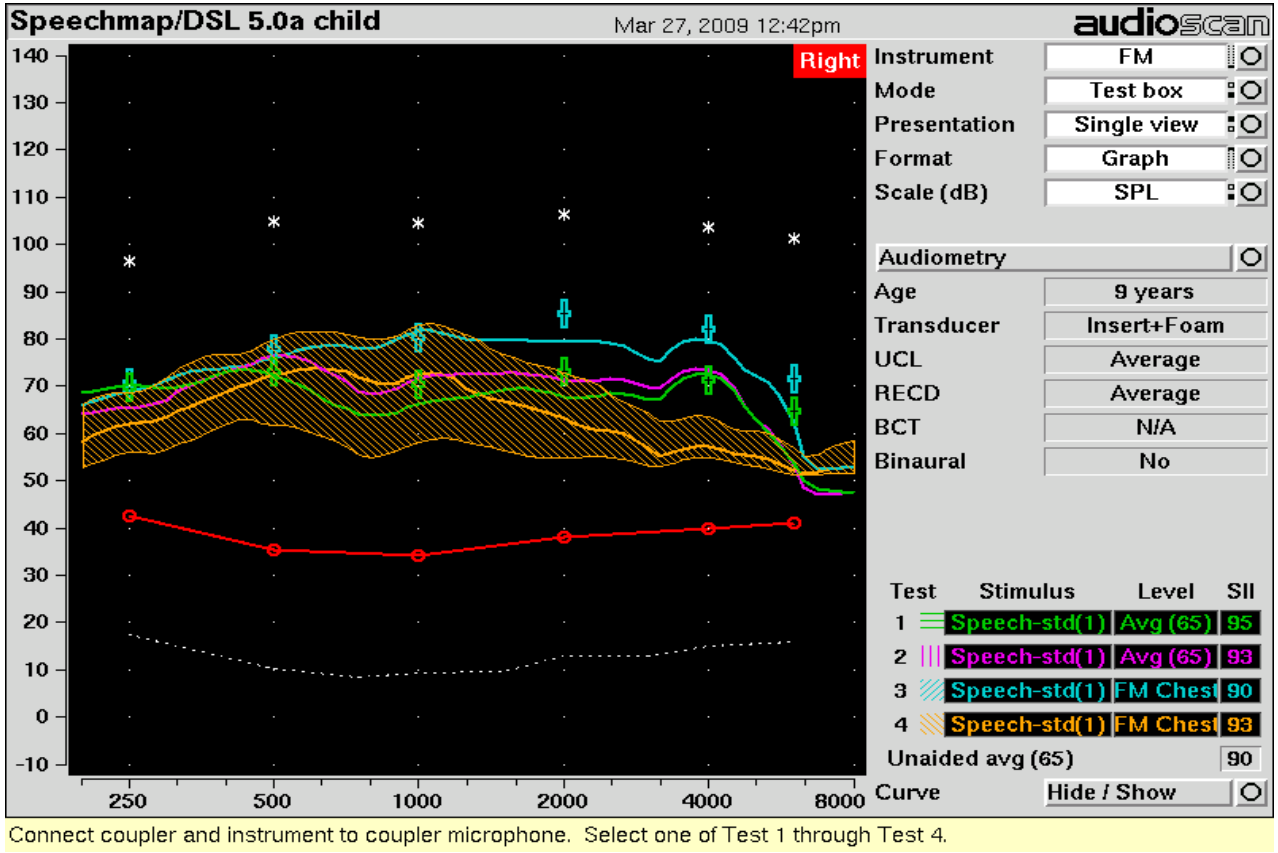
Oticon Amigo with Simeon 500WU

Omni Microphone (Aux Vol=Max, Rec Vol=11 o’clock)

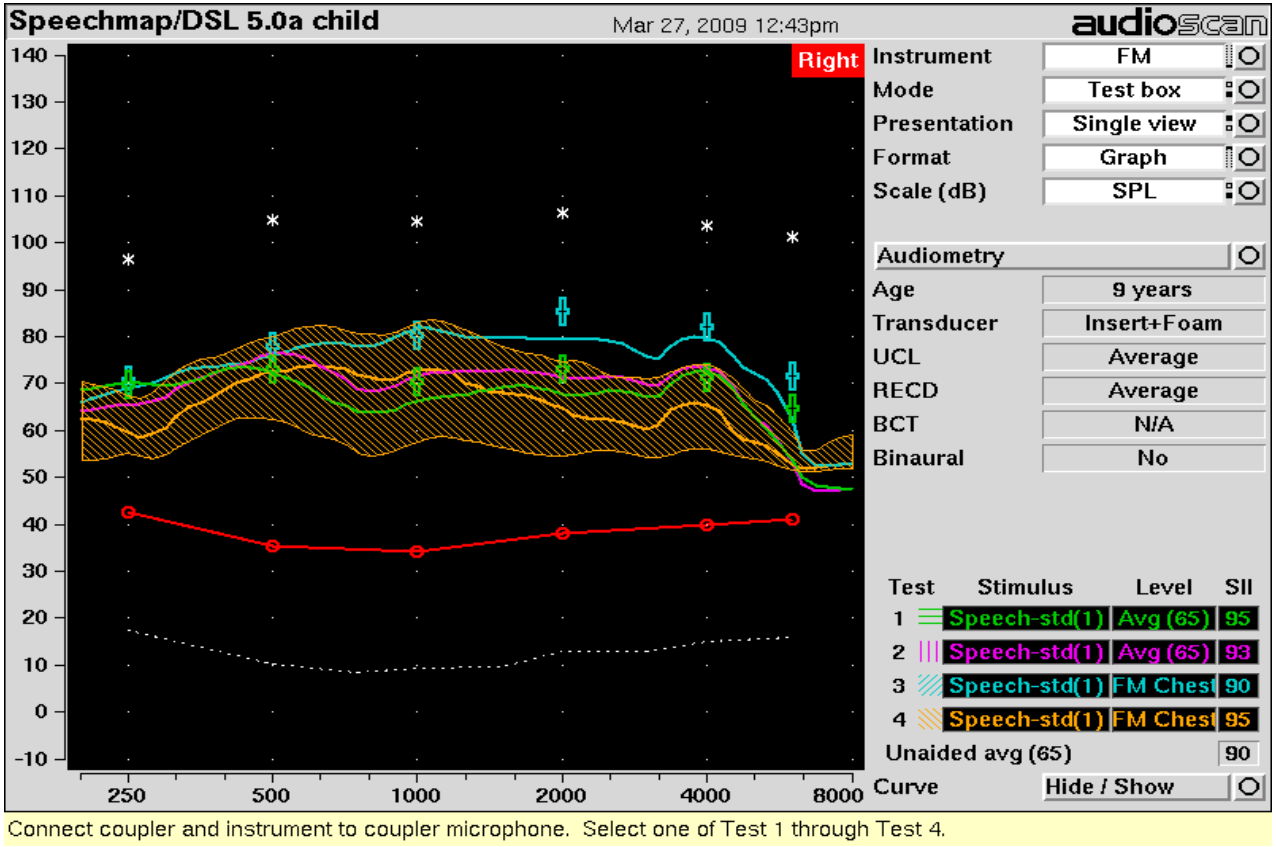


“Bad” Scenario

Phonak Inspiro with iLapel mic (default or general setting) with Simeon 500 WU Aux Vol=max, Rec= 11o’clock



Phonak Inspiro with lapel mic (IPOD Nano setting) with Simeon 500 WU Aux Vol=max, Rec= 11o'clock



"iPOD Nano" did not fix the high frequency roll off!

Conclusions from Auditory Management Services et al. (2009) study:

→ Results highly variable depending on equipment model and audio in/out settings

→ Frequency output in Patched condition matched Worn-Direct condition in 8 out of 22 configurations

→ ONLY patch when you have manufacturer-recommended Audio in/out settings

→ Without these settings, the student could be getting 5-25 dB less output compared to worn-direct

What about Sound Quality?
Verification & Monitoring Issues with Patching

- Clinical Verification of RM systems

Goals:

- to verify *transparency* between response from hearing aid alone and that from hearing aid coupled to RM receiver (transmitter muted)

- to ensure 10 dB advantage when a speech signal is entering the RM microphone

Assumption:

Teacher's voice is entering the RM transmitter via the transmitter microphone during actual classroom use.

What is the student hearing when the RM system is patched?

- When patched, the teacher's voice enters the RM transmitter via **audio input**.
- Transparency?
- 10 dB RM advantage?

What about Daily Behavioural Checks and Weekly Listening Checks?

→ Checks need to be done in the way the student is actually using the RM in the classroom.

Should you patch?

Do the advantages of having the sound field in the classroom outweigh the disadvantages of patching?

Schafer & Kleineck (2009):

- *Sound field systems **did not** significantly improve speech recognition in noise compared to HAs or CIs alone;*
- *While both desktop and personal FM provided significant benefit, personal FM provided significantly greater improvement (38%) compared to either sound field (3.5%) or desktop FM (17.1%)*

Anderson et al (2005):

- *Providing classroom sound field amplification as a means to benefit students with mild to profound bilateral HL appears to be an unjustified practice for approx. 80% of students with HL*

Sound fields are mainly for the benefit of the students with normal hearing and the teacher in the classroom.

When you MUST patch:

Please conduct:

1. Daily listening checks in **actual use setting**
2. Daily behavioural checks in **actual use setting**
3. Functional Listening Evaluation in **actual use setting**

Actual use setting:

1. Personal transmitter patched to sound field with audio-out setting adjusted to manufacturer-recommended;
2. Personal transmitter audio-in setting at “iPod Nano” or “Loud”;
3. Speak into the sound field mic;
4. Sound field volume turned low (when testing).

Alternatives to Patching

- Teacher wears two transmitters.
- Is a sound field really necessary? If so, consider one which is compatible with the student's personal RM transmitter.
- If a non-compatible sound field is in the hard-of-hearing student's room for the sake of the teacher or another student, consider moving the hard-of-hearing student to another room.

References

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