

Play It By Ear (California Lutheran University)

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INTRODUCTION/BACKGROUND

Three out of every 1000 children born in the United States are born with a hearing loss. Early intervention services and hearing technologies can help these students to compete academically with their hearing peers; but in athletics, students with hearing loss can have difficulty competing in sports and P.E. due to challenges with their hearing technology.

PROBLEM STATEMENT

Hearing aids are expensive, highly sensitive electronic devices that provide auditory access for people with hearing loss. The most common type of hearing aid worn by school-age students is the “BTE” or Behind-the-ear aid shown in Figure 1. This type of aid sits behind the student’s ear, with a tube that connects the processor to the ear mold inside the ear. Rather than risk damage to these sensitive devices, many students and their parents decide to forgo their use while playing sports – putting them at a disadvantage relative to their typically hearing peers and compromising their safety – or worse, these students give up in participating in sports activities altogether.

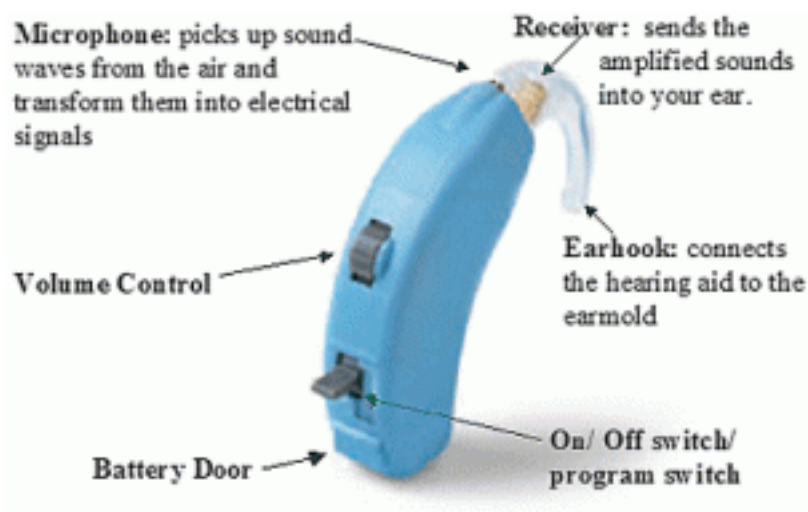


Figure 1

Anatomy of a Hearing Aid (illinoissoundbeginnings.org)

Special education teachers often encounter students experiencing problems and frustration during physical education and recreational sports activities. As hearing loss is an “invisible” disability, many coaches and teammates do not understand the difficulties encountered by the student with hearing loss and may become impatient or derisive when the student keeps asking people to repeat themselves, acts confused, or fails to follow instructions because of the inability to hear.

The issues of greatest concern for users of hearing aids with regard to sports are feedback, moisture, and impact.

Feedback

Whenever something gets too close to a hearing aid, it creates a feedback loop and a high-pitched squeal is emitted. This creates a problem for many helmets and head coverings. A frequent suggestion to eliminate feedback is to alter the helmet; but this is not a viable solution. In an article entitled “Head-to-Head With Helmets and Hearing Aids” (Fifer, R., 2009), the author states “Current research on helmet design...suggests the padding around the ears should not be modified in any way for two reasons: First, altering the energy-absorption characteristics of the helmet would decrease protection against physical head trauma; second, the plastic case of the hearing aid was not designed to be used in traumatic impact situations. Impact may not only cause damage to the hearing aid but it possibly increases the risk to the skin and skull in the immediate area of the hearing aid.”

Impact

Impact can both damage the hearing aid and cause injury to the student if the processor is compressed against the skull. However, for protection, students must be able to use protective head gear. This is especially true for the legal requirement that children under the age of 18 wear helmets while cycling. For safety reasons, while cycling (especially in urban environments), children need the use of both their helmet and their hearing technology.

Based on U.S. hospital emergency room records, the following is a list of sports and the number of head injuries for children age 14 and under in 2009:

- Cycling 40,272

- Football 21,878
 - Baseball & Softball 18,246
 - Basketball 14,952
 - Soccer 8,392
 - Winter Sports 6,750
- (American Association of Neurological Surgeons)

Protective equipment for athletes must be used for the safety of the student. Additionally, protection and use of the hearing aid needs to be maximized to allow students with hearing loss full participation in sports.

Moisture

Moisture of any kind, including perspiration, can be damaging to the sensitive electronic components of hearing aids. Students playing sports or exercising in hot weather frequently report problems with their hearing aids that are caused by perspiration getting into the aid.

Based on these needs, our design team has developed a low-cost workable solution to address the needs of student athletes with BTE hearing aids.

DESIGN AND DEVELOPMENT

To prevent injury to the ear and damage to the hearing aid, we took the hearing aids off the ears and placed them in a protective clamshell pouch that could be attached to the front of the player's uniform. Holes were drilled into the pouch to allow sound to reach the hearing aid microphone. As the earhooks are easily removed without requiring later adjustment to the hearing aid, we removed the earhook (but left it attached to the tubing and ear mold.) Tubes were attached directly to the opening for the ear hook and exited through holes in the protective pouch. The tubes lead up to a soft silicone ear bud that fits into the ear canal. The protective pouch prevents damage to the hearing aids. The soft ear bud prevents injury to the ear in case of impact. It also allows the player to wear a helmet or other protective headgear without causing feedback. The tubes can be made as long or short as needed. The protective pouch can be attached with Velcro, an armband, or suspended on a lanyard, depending on the sport and the preference of the player.



Figure 2 Device Closed



Figure 3 Device Open (showing aids inside)

The cost of the device to accommodate two hearing aids is around \$5. The protective pouches were \$3 each. Tubing is around .10 cents per foot, and the soft silicone ear pieces can be purchased for about \$1. This is reasonable, affordable accommodation that can provide better auditory access for thousands of student athletes with hearing loss.

EVALUATION AND RESULTS

The initial trial with the device produced results even better than expected. An adult who has a severe hearing loss tried the device, and claimed to hear as well with the device as he does with the hearing aids on his ear. In fact, he said, in some cases it was better because it cut down on some of the background noise that often caused a distraction.

One of our 6th grade students, “Romero”, is an avid basketball player. He plays in a community group as well as the school team, and has just received a scholarship to a summer basketball camp sponsored by the Lion’s Club. He has experienced problems with perspiration causing the hearing aids to not work properly, as well as issues with them flying off his ears during a game. As a result, he sometimes plays without them, but says that in those cases, his performance suffers as a result of not being able to hear his coach and the other players. He is eager to try the device.

We have also found that our device has become a solution for other problems:

An 8 year-old student who is severely disabled and lacks control of her head position was experiencing feedback from her hearing aids when in her wheelchair or placed lying on the floor. As a result, the classroom aides were removing her hearing aids and she was going through the school day without access to sound. This device has allowed her to use her hearing aids without the issues of feedback.

Hearing aid ear molds are custom fit to the wearer’s ear canals. When hearing aid molds do not fit tightly, feedback occurs. As children grow, the size and shape of their ear canals also change. It is not uncommon for children to need new molds as often as every six months when they are young. Ear molds are generally cast in the audiologist’s office and sent out to be made. This can take as long as a few weeks, meanwhile the old, ill-fitting ear mold is squealing whenever the child talks or chews or does anything to cause a gap between the ear canal and the ear mold. This device may be able to help in the interim, while the new molds are being made.

Because of immature eustachian tubes that are shorter and more horizontal than those of adults, children are prone to ear infections, and children who wear hearing aids are even more susceptible for a variety of reasons. Often, this causes tenderness in the ear canal and so the hearing aids aren’t used during this period, which could last for weeks at a time. The ear tips on our device are much softer and more malleable than most ear molds, and it is possible that this may be a viable option to not wearing the hearing aids

at all. We are working with an audiologist who has agreed to do a trial study of our device.

DISCUSSION

This simple, effective, and low-cost device has the potential to give greater auditory access to thousands of student athletes who wear BTE hearing aids. We are approaching leaders in the field of special education to see what we would need to do to have this device listed as an approved accommodation on students' IEPs. Given its affordable price and ease of use, we are hoping that it can get students with hearing loss off the sidelines and into the game.

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<http://youtu.be/CMKJUJpqzJs>

References:

Fifer, R. (2009) Head-to-Head With Helments and Hearing Aids. *The ASHA Leader*. Accessed 4/3/14 from <http://www.asha.org/Publications/leader/2009/090714/090714e.htm>