

# Break *the* Silence

Empowering Patients to Hear

By Dr Barrie Tan

**Hearing impairment is** a silent disease; it is often neglected but its effects can be crippling. It isolates its victims and makes them socially or economically less productive. Approximately 360,000<sup>1</sup> persons in Singapore suffer from hearing impairment, making it one of the most common conditions affecting Singaporeans. Furthermore, congenital deafness is the commonest major birth defect in Singapore, with a local prevalence of 1.7 in 1,000 newborns with severe to profound hearing loss<sup>2</sup>, and approximately 5 in 1,000 born with less significant hearing loss<sup>3</sup>. As physicians, our patients look to us to help them break out of this realm of silence and integrate back into society. With new technologies rapidly coming on stream, a whole gamut of hearing restoration strategies is now available, and the most suitable intervention can be nowadays tailored for almost every individual hearing need.

## Clinical Evaluation

The clinical evaluation begins with an otological history elucidating the time characteristics of the hearing loss including its onset and progression, identifying risk factors of hearing loss such as family history and excessive noise



exposure, as well as any associated complaints of vertigo and tinnitus. Physical examination would include an otoscopy to examine the external and middle ear. Tuning fork tests like Rinne's and Weber's can suggest the pattern of hearing loss. To further characterise the type and severity of hearing loss, audiological investigations such as pure tone audiograms and speech discrimination tests should be performed. Imaging investigations such as CT and MRI scans help in determining the aetiology and anatomical extent of the disease.

## Management

The holistic management of hearing loss involves managing the patients, their families and caregivers. Often, the family initiates the consult as they find it frustrating caring for a family member with hearing loss. Successful hearing rehabilitation leads to greater family harmony and emotional wellbeing. The patient's own aspirations for independence is also critical in management decision, as some surgeries allow for hearing restoration without the need to wear hearing devices or allow the patients to gain better

hearing where their existing hearing aids are inadequate for their needs.

If there is a surgically correctable cause of hearing loss (usually conductive) such as otosclerosis or ossicular chain abnormalities, the ideal solution would be to operate (eg, Stapedotomy or ossiculoplasty) so that the patient's hearing is restored without the need for any assistive hearing devices.

Modern amplification hearing aid technology has become very sophisticated. The new devices have advanced speech and signal processing capabilities that allow them to programme the appropriate hearing amplification pegged to the patient's pattern of hearing loss and the patient's environment. They are now much smaller and more powerful. Some are designed to be waterproof for use in water sports. Open fit hearing aids is a new delivery system that is more comfortable to wear, has less occlusion and feedback, and gives a more natural sound amplification. Some hearing aids can even connect wirelessly with telephones!

Arguably, the most exciting field of hearing restoration today is in the realm of surgical hearing implants. There are now a myriad of different surgically implantable hearing devices that cater to almost every possible hearing need.

### Cochlear Implants

Cochlear implants provide direct electrical stimulation to the auditory nerve endings in the cochlea, thereby bypassing problems in the cochlear hair cells, which account for a large majority of patients with sensorineural hearing loss. According to the United States Food and Drug Administration, as of December 2010, approximately 219,000 people worldwide have received cochlear implants.

Commonly referred to as a "bionic ear", cochlear implants have



**Figure 1.** A child wearing a cochlear implant

significantly transformed the lives of countless families with children born deaf. These deaf children can now hear. No longer are parents told that their child cannot develop speech and language skills. In fact, many of these children have gone on to outperform their normal hearing peers in mainstream education and contribute significantly in society. Nowadays children as young as six months old receive cochlear implants [Figure 1], and there is a trend towards bilateral cochlear implantation for better stereo sound localisation and performance in noisy environments. Many adults with bilateral severe to profound sensorineural hearing loss have also been implanted and been able to return to their active busy independent lifestyles.



**Figure 2.** The externally-worn speech processor of an EAS implant (Photo courtesy of MED-EL)

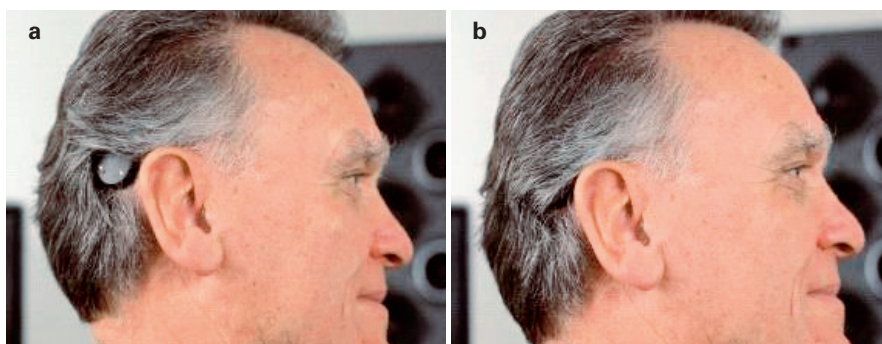
### Combined electric acoustic stimulation (EAS) implant

EAS is the concept of applying acoustic amplification and cochlear implant technology together in the same ear. EAS is a relatively new option for people with residual low-frequency hearing coupled with profound high-frequency hearing loss, often referred to as a ski-slope hearing loss. Hearing aids often provide unsatisfactory results in understanding speech or listening to complex sounds such as music for such persons. Traditional cochlear implant systems do not allow users to benefit from their residual natural hearing of low frequency sounds. The EAS speech processor [Figure 2] features acoustic amplification that supports a person's natural residual hearing

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**Figure 3.** A man wearing an active middle ear implant: (a) with the hair parted to show the external speech processor; (b) with the hair covering the processor (Photo courtesy of MED-EL)



**Figure 4.** A woman wearing the BAHA speech processor

in the low frequencies, and for the higher frequency sounds, the processor's cochlear implant function automatically takes over. The result is a synergistic effect offering the benefits of both types of hearing technologies.

#### Active middle ear implants

Active middle ear implants are another new group of surgical implants. They augment or replace the sound transmission capabilities of the ossicles. It comprises an internal component that is attached to a middle ear ossicle or to the round window, where it vibrates and provides direct mechanical drive and therefore increases the power of sound amplification of the ossicular chain. It can be used in patients with mild to severe sensorineural hearing loss, as well as in patients with mild to severe mixed or conductive hearing loss. The external ear canal is left entirely open and it therefore affords advantages over a hearing aid. It is more comfortable to wear; it has no occlusion effect, so low frequency sounds enter the ear naturally to give better quality hearing in noisy environments. In addition, it has less feedback and gives better high frequency gain. Semi-implantable devices have small cosmetically appealing, externally-worn sound processors hidden in the post-

auricular hairline [**Figure 3**]. Fully implantable versions have no externally worn components, resulting in even better cosmesis, and can be used when swimming or bathing.

#### Bone-anchored hearing aids (BAHA)

BAHA are a unique type of surgical hearing implants [**Figure 4**]. They comprise a titanium abutment screw that is surgically anchored into the skull bone behind the ear. The external speech processor clips onto the screw and converts sound into mechanical vibration that then vibrates the skull and activates the cochlea hearing via bone conduction. This has proven to be of immense benefit to two main groups of patients. The first are patients with conductive hearing loss and are not able to wear conventional hearing aids, such as children born with microtia or atresia of the external ear canals, or in patients with chronically

discharging ears. The second group are those with single-sided deafness, where sound can then be transmitted from the side of the deaf ear to the cochlea on the side of the good ear via bone conduction. This reduces "blind spots" of hearing on the side of the deaf ear.

#### Conclusion

The gift of hearing is often taken for granted until it is lost. Thankfully nowadays, you can help return that gift to your patients. A newly expanded armamentarium of surgical hearing implants, coupled with improved hearing aid technology, ensures that the overwhelming majority of your patients can hear well again. **MD**

#### Further Reading

- <sup>1</sup>Low WK. Managing hearing loss in children and adults: Singapore context. *Ann Acad Med Singapore* 2005;34(4): 295-300.
- <sup>2</sup>Low WK et al. Universal newborn hearing screening in Singapore: the need, implementation and challenges. *Ann Acad Med Singapore* 2005;34(4):301-6.
- <sup>3</sup>McMurray JS. Hearing screening in the newborn. *Curr Opin Otolaryng Head Neck Surg* 2000;8:465-8.



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