HEARING loss in the ageing patient is common. In recent Australian surveys, 26.6% of the population have some hearing impairment, while in the 70+ age group this prevalence rises to 87.5%. Deterioration of hearing with increasing age is not inevitable. As a case in point, the Mabaan people of Sudan are known to maintain a healthy diet, exercising daily, avoiding tobacco smoke and noisy environments; most of this population maintain their hearing in the normal range well into old age.

The normal processes of ageing affect all subsections of the ear, but it is the effects on the inner ear and the resultant sensorineural hearing loss that causes elderly patients the most morbidity. Presbycusis is the term used to describe sensorineural hearing loss secondary to the ageing process and is presumed to be the result of multiple, repeated insults to a patient's cochlear function. Presbycusis is both a diagnosis of exclusion and an umbrella term for multiple presumed pathological processes.

Damage to the cochlea occurs due to the age-related accumulation of genetic damage and gradual decline in the numbers of neural and supporting cells within the cochlea. Other possible causes of cochlear damage include:

- Noise.
- Repeated exposure to ototoxic medications.
- Vascular pathology.
- Inflammation from nearby middle-ear disease.

The higher incidence and greater severity of presbycusis in men is thought to be largely due to differences in noise exposure experienced by men and women in occupational and recreational activities. Cell population decline has been observed at all locations along the auditory pathway.

Central changes leading to difficulty with hearing can be classified as primary or secondary. Primary changes include reduced volume of brain tissue involved in auditory processing. Lipofuscin accumulation has also been noted in ageing central auditory neurons, as it has in ageing tissues elsewhere in the body. This senescent change is in addition to other pathologies common in the elderly that affect brain health, such as arteriosclerosis or respiratory failure. Overall, these hearing-related changes are referred to as central effects of biological ageing and have been found to cause difficulty in judging the duration of sounds, perceiving gaps in sounds and localising sounds in space.

Secondary brain changes occur in situations of auditory deprivation from hearing loss due to pathology anywhere in the ear. Hearing-loss-induced neuroplasticity, or central effects of peripheral pathology, can increase the sensitivity (decreased decibel threshold) of the deprived central auditory neurons, typically at the expense of frequency and temporal resolution. There is, however, evidence for beneficial neuroplasticity when auditory input is restored, such as with ‘aiding’ of a previously unaided ear (ie, use of a hearing aid or implanted device).
Hearing loss in the ageing patient

Classifying types of hearing loss

Hearing loss is broadly categorised into a loss of either conductive or sensorineural origin. Conductive hearing loss refers to a loss in the sound conduction system of the external ear, tympanic membrane and/or middle-ear bones. Sensorineural hearing loss refers to that due to damage of the cochlea, the cochlear nerve or higher auditory centres. A mixed hearing loss implies a component of conductive and sensorineural hearing loss (figure 1B, C, D).

Hearing loss in the elderly is predominantly sensorineural in nature. It is accepted that the exact site of sensorineural hearing loss has an effect on the type of disability experienced. Retrocochlear pathologies (see table 1) are often associated with disproportionately poor speech understanding scores compared with the patient’s actual decibel hearing thresholds. Cochlear pathology is generally associated with speech understanding scores in line with the patient’s hearing thresholds, but decreased dynamic range of hearing (the difference between the softest sound we can perceive and the loudest [painful] normal is about 120 dB).

Table 1: Glossary of commonly used audiology terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head shadow</td>
<td>Head shadow is exactly what it sounds like, an acoustic shadow due to obstruction of sound by the head. In binaural hearing, the effect of the head shadow is vital in sound localisation. Head shadow causes particular difficulty for people with single-sided deafness.</td>
</tr>
<tr>
<td>Interaural attenuation</td>
<td>Interaural attenuation is the sound energy lost between presentation of an auditory stimulus at one ear, and perception of the sound by the contralateral cochlea. Interaural attenuation for a given source depends on both the frequency of the sound (higher frequencies are attenuated less than lower frequencies) and the way that the sound is presented. There is no attenuation of sound presented directly on bone. Conventional air-conduction earphones still transmit a portion of their output directly into bone, with a result that interaural attenuation of their stimulus is between 40 and 60dBHL (decibel hearing level). Inset earphones transmit very little stimulus directly to bone, with resultant interaural attenuation of &gt;70dBHL.</td>
</tr>
<tr>
<td>Loudness recruitment</td>
<td>Elevated hearing thresholds with a narrow dynamic range of hearing. Once above the threshold, the perceived increase in sound intensity is greater than the actual increase in sound intensity. A small increase in sound intensity above threshold can therefore lead to an uncomfortable increase in perceived sound intensity, occasionally resulting in pain.</td>
</tr>
<tr>
<td>Post-lingual deafness</td>
<td>Refers to the onset of deafness after the time at which a patient has developed speech and language skills. Auditory memory developed between development of language and the onset of deafness has implications for hearing rehabilitation. In the context of cochlear implantation, rehabilitation can involve months of re-education/rehabilitation with an audiologist before a patient gains maximal benefit from their new hearing.</td>
</tr>
<tr>
<td>Pure tone average</td>
<td>Average of the pure tone thresholds (in dBHL) at 500, 1000 and 2000Hz (the usual range of human communication).</td>
</tr>
<tr>
<td>Retrocochlear pathology</td>
<td>Refers to pathology in the eighth (Cochlear) nerve or the cerebellopontine angle in the area of the eighth nerve. Gadolinium-enhanced MRI is the investigation of choice for possible retrocochlear lesions, though audiological investigations can be reasonably accurate in determining the site of eighth nerve dysfunction.</td>
</tr>
<tr>
<td>Rollover</td>
<td>An audiological phenomenon characteristically seen in retrocochlear pathology. The patient’s speech discrimination increases with increasing sound intensity to a point before falling rapidly with further increases.</td>
</tr>
<tr>
<td>Telecoil</td>
<td>A telecoil is a magnetic coil within a hearing aid or speech processor for the purpose of receiving auditory information transmitted by an individual or large-area inductive loop.</td>
</tr>
<tr>
<td>Tonotopic organisation</td>
<td>Cell populations throughout the auditory system are organised ‘tonotopically’, or according to the frequency of auditory stimulus to which they will respond. This is particularly important in the cochlea, where the basal portion of the cochlea (closest to the round and oval windows) is responsible for perception of high frequency sounds. Lower frequency sounds are perceived further towards the apex of the cochlea.</td>
</tr>
</tbody>
</table>

Figure 1: A: Audiogram demonstrating bands of hearing loss severity and notation. B: Pure tone audiogram, demonstrating a largely symmetrical, down-sloping, mild-to-severe sensorineural hearing loss. C: A largely flat, mild to moderate, right-sided conductive hearing loss. D: Audiogram demonstrating a largely flat, moderate mixed hearing loss on the left side. There is a mild-to-moderate sensorineural hearing loss in most frequencies with about 20dB of conductive overlay.

<table>
<thead>
<tr>
<th>Frequency in Hz</th>
<th>Modality</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>Air conduction - Earphones</td>
<td>Unmasked</td>
<td>Masked</td>
</tr>
<tr>
<td>250</td>
<td>Bone sound field</td>
<td>Unmasked</td>
<td>Masked</td>
</tr>
<tr>
<td>500</td>
<td>Bone Conduction</td>
<td>Unmasked</td>
<td>Masked</td>
</tr>
</tbody>
</table>

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### Management

**The effects of hearing loss on the ageing patient**

The psychological, emotional and financial burdens of hearing loss on the ageing patient are significant and well established. Hearing loss can cause feelings of isolation, both on the part of the patient and the people close to them. When combined with a lack of understanding on the part of the people attempting to communicate with the patient, hearing loss strains relationships. Dissatisfaction with, or unwillingness to use, hearing aids can cause family members and friends to feel that the patient does not care about them enough to try to communicate. Although some patients may be accepting of hearing loss, others may feel that acknowledging their disability by seeking treatment is an admission of either their age, or may reveal their vanity.

Furthermore, hearing loss can compromise a patient’s ability to perform their activities of daily living as well as reducing their enjoyment of these activities. Difficulties in communication can also negatively affect a patient’s health because of the inability to perceive auditory alerts (e.g., to dangers), and because of interference with participation in medical and allied health interventions. Elderly patients with a hearing disability have also been found to have rates of depression almost twice as high as those in the same age group with preserved hearing.11

Key management options are summarised in the box above.

---

**Alerting devices**

Alerting devices are designed to convert these alerts into either vibro-tactile or visual stimuli. Alerting devices may be specific to smoke alarms. A smoke alarm can be life threatening. There are typically attached to a vibrating pad, designed to be placed in a user’s existing hearing aid. (Image courtesy of GN ReSound, Sweden.)

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**Hearing assistive listening devices**

Hearing aids are the next step in hearing loss management for the elderly. When the above options have been exhausted and the patient still has many acoustically challenging environments. Conventional hearing aids are referred to audiologically as air-conduction hearing aids, with sound being amplified and transmitted through the normal auditory system. There are two broad types of air conduction hearing aid, the behind-the-ear (BTE) and the in-the-ear (ITE) aid.

Behind the ear

BTE hearing aids consist of a microphone, receiver and processor package that rests behind the pinna, con- nected by a polyethylene tube to a custom-made ear mould for the amplified output (figure 4A, B, page 32). BTE aids are generally less expensive than their ITE counterparts, and the bulky size of the BTE package allows for higher output gain and battery capacity.

Patients with poor manual dexterity may find ITE difficult to fit, but the larger package does allow manual volume or telecoil controls to be made larger. The ear mould has ventilation ports to allow dehumidiﬁcation of the ear canal. The ventilation ports also lessen the amplification of low frequencies (which are generally preserved in the ageing patient), this decreases the feeling of blockage in the ear, called the occlusion effect. The separation of the microphone and output also means that acoustic feedback is reduced.

In the ear

ITE hearing aids consist of a single package, containing microphone, receiver, processor and output, sur- rounded by a custom-made shell to fit within a particular subsection of the external ear. The ITE can be well ﬁtted with hearing aids. The GP should not understand that because the patient is hearing well in one-to-one situation that no problem exists. Rather, questions about their hearing in real-world situations are far more important. After an audiogram and conﬁrmation of poor hearing, a referral to the ENT surgeon is generally the next step.

---

**Advice a GP can give to family and friends of deaf patients**

- **DO**
  - **Wait until the hearing-impaired person can see you before speaking.** Touch is helpful to get their attention.
  - **Position yourself close to the person when speaking.**
  - **Speak at a normal rate and try to enunciate clearly.**
  - **Reduce background and competing noise.**
  - **Clue the person into any changes in the conversation topic.**

- **DON’T**
  - **Speak from another room or while walking away.**
  - **Speak directly into the person’s ear (this distorts the message and hides visual clues).**
  - **Shout (this may distort the message).**
  - **Cover your mouth with your hands while speaking.**
  - **Repeat the statement if it is not understood (it is better to rephrase).**

For a downloadable PDF patient handout see: www.northsidehearing.com.au

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**Hearing aids**

Air-conduction hearing aids

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We rely on a remarkable number of acoustic signals to gain our attention or alert us to danger. The inability to hear a doorbell or alarm clock may be an annoyance, but the inability to hear a smoke alarm can be life threatening.

Alerting devices are designed to convert these alerts into either vibro-tactile or visual stimuli. Alerting devices may be specific to one device or source, or may integrate monitoring of several sources. Portable vibro-tactile receivers are generally packaged in the form of a wristwatch or pager, while alarm-clock receivers are typically attached to a vibrating pad, designed to be placed under the patient’s pillow (figure 3A, B).
and ITC aids, as inadvertent ventilation can lead to consid-
erable acoustic feedback. Smaller aid packages also mean less accessible surfaces for the controls, which make automatic volume controls and speech-detection systems invaluable. Remote controls are also an option for patients with limited manual dexterity.

Regardless of the choice of a BTE or an ITC package, an ear mould is required, and changes to the external ear in older people make this process more difficult. In the elderly, changes in wax pro-
duction and migration, hair density and skin quality may mean that a correct fit is dif-
cult to achieve and ports are frequently blocked by wax.

Although many older patients are eligible for gov-
ernment-subsidised hearing aids (see box, far right), they may be dissatisfied with the performance of these aids. Extra features that older patients may require are avail-
able with co-payments to the government scheme.

Reasons why patients may not receive approval for hear-
ing aids are shown in table 2.

When hearing aids are appropriately fitted and tuned, about 70% of patients will have notable reduction in their hearing-related disability, while just over half will note improvement in their quality of life.

Single-sided deafness

Single-sided deafness may go undiagnosed for some time because of relatively normal hearing on the unaffected side. Patients with single-sided deafness are difficult to fit with conventional air-conduction aids, as a hearing aid in the affected ear typically provides a distorted sound compared with the normal hearing on their opposite side.

The disability caused by single-sided deafness is greater than just the inability to per-
ceive auditory stimuli on the affected side. The loss of binaural hearing has been shown to reduce the ability to locate an unseen sound in space, as well as to decrease perception of speech in noisy environ-
ments. Additionally, the over-all “effort of listening” is increased in common situa-
tions, leading to increased tiredness and frustration.

Bone-conduction devices

Bone-conduction hearing devices may be offered to patients who are not suitable for conventional air-conduc-
tion aids. Bone-conduction hearing aids employ a system of microphones and signal processors, as with any other modern hearing aid, but differ in the method of output. The signal processor is connected to an oscillator, which when placed adjacent to the bone of the skull, transmits the audi-
tory stimulus into the bone as a vibration that is perceived as sound by the functional cochlea(s). The oscillator must be held firmly against the skull to facilitate transmission of the vibratory stimulus through skin and subcutaneous tissue to the underlying bone, so a light-fitting metal headband is usually used. This headband can be both uncomfortable and aesthetically unpleasing.

**Contraclateral routing of sound**

Contraclateral routing of sound (CROS) refers to the gathering of auditory infor-
mation from one ear and transferring it to the better-hearing ear (cross-aiding). In general, bone-conduction hearing aids are cross-aids, as the vibration conducted through bone stimulates both inner ears. With ar-
conduction CROS aids, the patient wears a hearing-aid mould in their better-hearing ear, typically connected to the contraclaterally placed microphone package by a headband.

The same complaints about poor comfort levels and cosmetic appeal apply to air-condu-
cation CROS aids as to bone-conduction CROS aids, but with the added disadvantage of occlusion of the better-hearing ear’s external canal. Hear-
ing benefits from CROS aids are thought to be modest at best.

**Bone-conduction implants**

Bone-conduction implants were first developed in Sweden in 1977 and have been commercially available since 1987. These devices seek to build on the benefits of bone-conduction hearing aids while reducing the perceived disadvan-
tages.

The device consists of an external microphone, processor and oscilla-
tor, which are usually combined in a single package, together with a tita-
nium coupling (the abutment) and a titanium implant. The titanium implant is inserted into mastoid or calvarial bone and allowed to osteointegrate before being attached to the external package via the abut-
ment (figure 5).

This direct transmission from the

**Figure 5:** The Cochlear Baha bone-anchored hearing implant sends sounds directly through the skull, bypassing a defective conduction system to directly stimulate the cochlea. (Image courtesy of Cochlear Corporation.)

Table 2: Why patients may not receive approval for conventional air-conduction hearing aids

<table>
<thead>
<tr>
<th>Condition</th>
<th>Reason for non-approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microtia or aural atresia</td>
<td>Abnormalities in the conformation of the pinna may make fitting of a BTE hearing aid impossible. Narrow ear canals in lower grades of aural atresia make fitting of moulds difficult, while higher-grade aural atresia will obtain little, if any, benefit from air-conduction aiding</td>
</tr>
<tr>
<td>Discharging ears:</td>
<td></td>
</tr>
<tr>
<td>• Recurrent otitis externa</td>
<td>Discharge will decrease the effective output of an air-conduction aid, while the presence of the mould will make effective treatment of the infection impossible</td>
</tr>
<tr>
<td>• Discharging otitis media</td>
<td></td>
</tr>
<tr>
<td>Dermatological conditions of the ear canal</td>
<td></td>
</tr>
<tr>
<td>Further investigation required</td>
<td>An ENT surgeon may delay approval for aiding pending further investigation of a patient’s hearing loss (see table 3)</td>
</tr>
</tbody>
</table>

Table 3: Red flags that warrant referral for further assessment

<table>
<thead>
<tr>
<th>Red flag</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymmetrical sensorineural hearing loss</td>
<td>Can be a presenting feature of a cerebellopontine angle tumour, eg, vestibular schwannoma</td>
</tr>
<tr>
<td>Associated cranial nerve deficits</td>
<td>May be due to, eg, facial nerve palsy in destructive inflammatory or neoplastic processes of the temporal bone</td>
</tr>
<tr>
<td>Ear canal or middle-ear mass</td>
<td>Can be due to, eg, squamous cell carcinoma or adenoid cystic carcinoma of the ear canal presenting as a conductive hearing loss</td>
</tr>
<tr>
<td>Deep ear pain</td>
<td>May be indicative of a destructive inflammatory or neoplastic process involving the temporal bone</td>
</tr>
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**Hearing implants**

**Bone-anchored hearing implants**

Bone-anchored hearing implants are frequently blocked by hair and changes to the external ear in older people make this process more difficult. In the elderly, changes in wax pro-
duction and migration, hair density and skin quality may mean that a correct fit is dif-
cult to achieve and ports are frequently blocked by wax.

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ing benefits from CROS aids are thought to be modest at best.
from previous page

in patients with chronic suppurative otitis media, in whom frequently discharging ears made aiding of conductive or mixed hearing losses difficult without wors- ening the infection (see table 2).

**Middle-ear implants**

The goal of middle-ear implants is amplification of normal ossicular chain movement as an alternative to conventional hearing aids in the treatment of patients with moderate to severe sensorineural loss. The most commonly seen middle-ear implant, the Vibrant Soundbridge, from Med-El, uses an electromagnetic driver attached to the incus to stimulate the stapes.

Surgery is required to place the implant through the mastoid bone into the middle ear. The electromagnetic driver, known as the floating mass transducer, is attached to a receiver/stimulator package, which is placed underneath the skin, behind the mastoid cavity. The external microphone/processor unit is coupled to the internal receiver/stimulator via a magnet and induction coil. For a middle-ear implant the patient must be fit to undergo a surgical procedure and must have a healthy middle ear. Implanted devices such as the Vibrant Soundbridge allow treatment of moderate to severe sensorineural losses while avoiding occlusion of the ear canal. Directly driving the ossicular chain reduces the effect of acoustic distortion inherent in higher levels of amplification, with particular advantages in amplification of high frequencies. Direct stimulation of the ossicular chain means that this is essentially a single-sided stimulus and patients can maintain two sound fields, with resultant benefits in terms of sound localization, compared with bone-conduction devices.

More recently, patients have been treated with a Vibrant Soundbridge device for mixed or conductive losses in the mild to severe range. For this indication the floating mass transducer is placed next to the round window in the middle ear to provide direct mechanical stimulation of the round-window membrane.

Other strategies for middle-ear implantation include placement of a magnet on the ossicular chain, which is driven by a coil, included in a package similar to two sound fields, with resultant benefits in terms of sound localization, compared with bone-conduction devices.

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**Cochlear implantation**

Most cochlear implant recipients each year are adults, often deafened by the process of ageing, and who do not gain any benefit from conventional BTE hearing aids. The cochlea is entered from the middle ear, either directly through the membrane of the round window, or through a hole (a cochleostomy) drilled adjacent to the round window. The cochlear implant electrode (see figure 7) is then inserted into the lumen of the cochlea, preferably within the space known as the scala tympani. Some surgeons will further fix the implant package in place with sutures. The skin and subcuta- neous tissues are closed in layers over the cochlear implant and mastoid defect. While the patient is still anaesthetised, intraoperative testing of the implant is often performed to test the integrity of the implant.

Partial deafness cochlear implantation

Partial deafness cochlear implantation is the practice of electrical stimulation of the cochlea via a cochlear implant electrode for only part of the frequency spectrum. Earlier implants and surgical techniques resulted in the destruction of any residual acoustic (ie, natural) hearing during the implant procedure. Recent advances mean that residual low-frequency hearing can be preserved reasonably reliably. An extension of this concept is combining electrical stimulation of high frequen- cies using a cochlear implant, and acoustic amplification of low frequencies via a air-conduction hearing aid. The BTE components of the cochlear implant processor and air-conduction hearing aid are combined in one package (figure 8A, B).

References


Online resources

• Northside Audiology: www.northsidehearing.com.au
• Hearing Aid Forums: www.hearingaidsforums.com
• Advanced Bionics — Learning centre: www.advancedbionics.com/CMS/Rehab-Education/Learning-Center/
• Better hearing institute: www.betterhearing.org
• RNID — Action on hearing loss: www.rnid.org.uk/information_resources

www.waustinlanddoctor.com.au

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**Table 1**

- **Cochlear implants:**
  - Advanced Bionics: Low profile, small size.
  - Freedom: High quality bone hearing aid.

**Figure 6**: Cochlear implantation. A graphic demonstrating the cochlear implant electrode array directly inserted into the cochlea, stimulating the spiral ganglion neurons and in turn, the cochlear nerve. (Image courtesy of Cochlear Corporation.)

**Figure 7**: A Cochlear implant device, demonstrating the Nucleus receiver/stimulator package, straight ground electrode and processed electrical array that is inserted into the cochlea. (Image courtesy of Cochlear Corporation.)

**Figure 8A**: An electro-acoustic stimulation system, consisting of a Sachs cochlear implant with FlexAE electrode and a combination of speech processor and air-conduction hearing aid in the Short 2 BTE package. (Image courtesy of MED-EL GmbH.)

**Figure 8B**: A patient wearing a Cochlear Hybrid device. (Image courtesy of Cochlear Corporation.)

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a) If the patient is hearing well in a one-to-one consultation, when Mrs B discussed her husband, and how Mrs B often complained about her husband, and how it was just easier for her to do everything, as he was becoming forgetful and distracted.

It was only during one consultation, when Mrs B needed to provide a urine sample that I was left alone with Mr B. It was only then that I realised how hard he was actually talking, I talked more slowly and more loudly but he still found it hard to make out what I was saying.

When Mrs B returned I asked her about this and the need for a hearing test and maybe a hearing aid. Mrs B said that Mr B had hearing aids but they made no difference at all so he didn’t bother to wear them. I checked his ears, and his canals were filled with enough wax to make a candle or two! Both of them were amazed how well his hearing aids worked after his ears had been syringed.

Questions

Wax build-up is a constant problem with hearing aids. Do you suggest regular use of wax-clearing agents as a preventive?

Cerumen (wax) build-up is indeed a frequent problem with hearing aids. Regular use of cerumenolytics may be beneficial for some patients, but cerumen has protective properties that may be beneficial for others. Patients may experience an initial dermatitis but if the products are appropriately used, they can be helpful in assisting wax to come out naturally.

The aids themselves can also cause irritation of the canal, and during treatment the users are unable to wear their aids. Are there any suggestions to minimise these occurrences?

Ear canal dematitis secondary to allergy to hearing aids is often multifactorial. Patients may experience an instant dermatitis due to components of the aid, such as either the acrylics or the gold. Most patients with aid-related dermatitis will have problems related to the occlusion of their ear canal. Occlusion of the ear canal alters the environment in the ear canal through humidiﬁcation and interruption of cerumen migration. Excessive ear wax or mobile aids can also cause direct trauma to the canal skin.

How often do you recommend patients be reassessed regarding their hearing aids?

A yearly visit to a hearing professional will allow for cleaning of hearing aids as well as periodic re-evaluation of the aid’s effectiveness.

There are many ﬂaws in the current government scheme, especially with an increasing proportion of elderly patients in the community. Can any of the newer more effective hearing aids be produced more cost-effectively to help alleviate the ﬁnancial burden?

With advances in design and manufacturing processes, one would hope that manufacturing costs of aids would fall. Overlap of technologies between hearing aids and other devices such as mobile phones and music devices should further reduce manufacturing cost through higher production volumes. This decrease in cost for manufacturers will inevitably be offset by the development and inclusion of new technologies.

When purchasing hearing aids, patients should be aware that the device with the most out-of-pocket expense may be packed with the latest technologies, but these technologies may be surplus to their requirements and may, especially in the case of miniaturisation, make their aids less user-friendly.

Have mobile phones been found to cause any noticeable hearing loss in hearing loss?

In a frequently quoted study in India, no signiﬁcant difference in audiometric measures between long-term mobile phone users and non-users was seen. However, there was a trend towards an association between heavier long-term use of mobile phones and an increased rate of high-frequency sensorineural hearing losses.1 This study suffered because of its small population and retrospective nature.

At this stage there is no convincing evidence of a detrimental effect of mobile phone use on hearing. One caveat is the use of earphones as part of a hands-free device, where the user has to be mindful of the recognised dangers of listening at excessive volumes for long periods. The European Union requires manufacturers of portable music players and mobile phones to impose volume limits, but this requirement has not been imposed in Australia.

Reference


INSTRUCTIONS

Complete this quiz online and ﬁll in the GP evaluation form to earn 2 CPD or PDP points. We no longer accept answers by post or fax.

The marked required to obtain points is 80%. Please note that some questions have more than one correct answer.

1. Which TWO statements are correct?

1. Which TWO statements are correct?

2. Which TWO statements are correct?

3. Which TWO statements are correct?

4. Which THREE statements are correct regarding hearing-assisting listening devices?

5. Which TWO statements are correct regarding hearing aids?

6. Which THREE statements are correct regarding in-the-ear (ITE) hearing aids?

7. Which TWO statements are correct?

8. Which TWO statements are correct?

9. Which TWO statements are correct?

On the next page you will find the complete answers.