## **Dialogue with Residents: Understanding Sensorineural Hearing Loss**

The Sensorineural hearing loss (SNHL) results in a number of hearing related problems to the patients. The principal complaint of these patients is their inability to understand speech especially in the presence of background noise or reverberant situations. The modern hearing aids have been equipped with a number of new features to overcome this handicap of patients but still the patient satisfaction rate is not very high. An understanding of the components of SNHL is essential to better analyse this symptom. These components of SNHL include (but are not limited to) the following:

**Decreased audibility**: Patients with severe or profound hearing loss may not hear any speech sound without being shouted to from a closed range. This occurs as essential parts of some phenomes are not audible to the patients e.g. in order to recognise a vowel the patient needs to be able to listen to its second and third forments. These forments are high frequency in character and if these forments are not recognised the patient is unable to differentiate between different vowels. High frequency components of speech are weak (in terms of energy) as compared to low frequencies. Most commonly hearing impaired people miss high frequency information.

**Decreased dynamic range**: Dynamic range is the difference between the just audible threshold of a frequency and the discomfort level. SNHL raises the threshold of hearing much more than it increases the threshold of loudness discomfort, resulting in a decrease in dynamic range. Recruitment is another feature of SNHL which affects dynamic range in SNHL. The implication of reduced dynamic range that a hearing aid must give more amplification to weak than it does to intense sound.

**Decreased frequency resolution**: Patients with SNHL are faced with the difficulty of separating sound with different frequencies. The outer hear cells (OHC) increase the sensitivity of cochlea for frequencies to which that part of cochlea is tuned. When OHCs lose their ability to amplify their characteristic frequency, cochlea loses some of its frequency selectivity. The significance of this deficit is that even when a speech component and have different frequencies, if these frequencies are too close the cochlea will have a single broad range of activity rather than two regional peaks. Another component of decreased frequency resolution is upward spread of masking. It means intense low frequency sounds mask high frequency components of speech. Impaired frequency resolution and resultant poor speech discrimination are determined by degree of hearing loss.

**Decreased temporal resolution**: Intense sounds can mask weaker sounds that immediately precede or follow them. Temporal masking happens to a greater extent for people with SNHL and adversely affects speech intelligibility.

**Physiological origins of SNHL**: In SNHL both OHC and Inner Hair Cells (IHC) can cease to function normally. If only OHC are affected then hearing thresholds are elevated, dynamic range is reduced and frequency and temporal resolution are impaired. When only IHC are affected while thresholds are elevated, however frequency resolution is normal or near normal. Temporal resolution may be impaired. When IHC stop to function it is common for corresponding spiral ganglion cells to die as well. Another type of loss is caused poorly working cochlear battery, the stria vascularis.

Each of the above aspects of hearing loss can cause speech intelligibility. Any combination of these can cause a hearing impaired person to understand much less than a normal hearing individual, even when the hearing impaired person is wearing a hearing aid. (Dillon, 2012)

## References

Dillon, H. (2012). Hearing Aids. In H. Dillon, *Hearing Aids* (pp. 2-6). Boomerang Press.