INTRODUCTION

SINGLE-SIDED DEAFNESS: SSD is a term used to describe individuals with severe to profound hearing loss in one ear with a universal trend of having preserved or admissible audiometric thresholds in the unaffected ear. Though SSD is the most common cause of SSD, though other etiologies are well documented including Meniere’s disease, unilateral vestibular schwannoma, temporal bone fracture, meningitis, unilateral noise damage and ototoxic drug exposure (Giardina et al. 2014).

BINAURAL HEARING: Binaural hearing has been demonstrated to be superior to unilateral hearing in regards to speech perception in noise and sound localization (Buss et al. 2008; Dubno et al. 2008).

Head-shadow effect: A phenomenon that occurs when the head obstructs sounds arriving from different locations. It allows the listener to always be able to utilize the ear with the more favorable SNR.

Binaural summation: Binaural summation causes an increase in loudness of the signal. In addition, it allows for redundancies in the auditory signal which may result in greater frequency and intensity discrimination.

Binaural squelch effect: The advantage gained through the addition of the ear with the poorer SNR compared to listening monaurally with the better SNR. This allows for comparison of timing, amplitude and spectral differences in the signals arriving from each ear which provides a greater representation of the signal (Tyler et al., 2002).

SPEECH PERCEPTION IN NOISE: The benefits of binaural stimulation for speech comprehension are specifically attributed to the effects of binaural summation and binaural squelch.

Binaural squelch: Allows for the brain to selectively filter noise from an incoming sound, particularly when noise and speech have different sources. Between sound level and timing can be made (Wanrooij & Opstal, 2008). For monaural listening, speech increases in noise threshold.

Binaural summation: Phenomenon that results in an additive effect of elevation that occurs when the head shadow obstructs sounds arriving from different locations. It allows for comparison of timing, amplitude and spectral differences in the signals arriving from each ear which provides a greater representation of the signal (Tyler et al., 2002).

LOCALIZATION: Dependent upon accurate calculation of three spatial coordinates including azimuth, elevation, and distance. Directional hearing for determining the azimuth of a signal depends on binaural differences in sound arrival time and interaural level differences caused by the head shadow effect for higher frequencies. Monaural listeners lack these cues, as interaural comparisons between sound level and timing can be made (Wanrooij & Opstal, 2007). Monaural cues for sound localization are limited to acoustic changes caused by the outer ear structures including the pinna and external auditory canal (Tokita et al. 2004). For monaural listening, acoustic cues derived from the modifications in the spatial composition of the signal are ineffective in aiding in horizontal localization (Giardina et al. 2014).

COCHLEAR IMPLANTATION AS A TREATMENT OPTION FOR ADULTS WITH POST-LINGUAL SINGLE SIDED DEAFNESS: A SYSTEMATIC REVIEW OF THE LITERATURE

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INTRODUCTION

TRADITIONAL TREATMENT OPTIONS FOR SSD

Traditional treatment options for SSD include the CROS system, and more recently ossiculoplasty and bone conduction hearing devices. These treatments provide the same goal, routing of the signal to the better, contralateral ear.

CROS: Wireless transmission and presentation to the contralateral ear via bone conduction, which is ineffective in improving listener’s experience in noise and in regards to localisation function (Van de Heyning et al., 2008).

BONE CONDUCTION OPTIONS: Comparison of CROS and bone conduction options has been written about extensively in medical literature. However, they are not unique to the SSD condition. The Cochlear implantation, COCHLEAR, HOPE, and others.

METHODS

Speech perception in noise and localization are compromised in individuals with SSD. Cochlear implantation was introduced as an experimental treatment option for patients with bilateral hearing loss (Arid et al, 2003).

STATEMENT OF PURPOSE

SPEECH IN NOISE

• 5 out of the 6 studies reported benefits in speech in noise for at least one spatial configuration.

• Stelzig et al. (2010) reported significant improvement in the Freiburg monosyllabic word test and HSM sentence test in the SSD condition (binaural summation) whereas improvements noted in the SSD condition were not unique.

RESULTS & DISCUSSION

LIMITATIONS OF THE RESEARCH ON TREATMENT EFFECTIVENESS

• Majority of studies on this topic are of low or moderate levels of evidence.

• No randomized studies and actual numbers of participants in each study remain very low.

• Large degree of heterogeneity in terms of the classification of SSD (degrees of hearing in the contralateral ear), duration of deafness, age at implantation, and test conditions, materials and methodology. Differences between test methodology and spatial configurations for SPIN testing may have led to variable results on this outcome measure.

• Follow-up duration post implantation is a limitation for many of the included studies. It is well known that performance with CIs often improves with time and experience. With some research suggesting continuing improvements up to 30 months post-implantation. SSD therefore need further demonstration of speech in noise performance in current SSD literature.

• Van de Heyning et al. (2008) provided critical data that indicates CI as an effective long-term treatment option for patients with SSD and unilateral temporal hearing loss.

REFERENCES


