

Phonak CROS II

The smart solution for single-sided deafness



What is single-sided deafness?

Single-sided deafness (SSD), also referred to as unilateral hearing loss (UHL) or asymmetric hearing loss, occurs when an individual has impaired hearing in one ear but little or no impairment in the other ear.

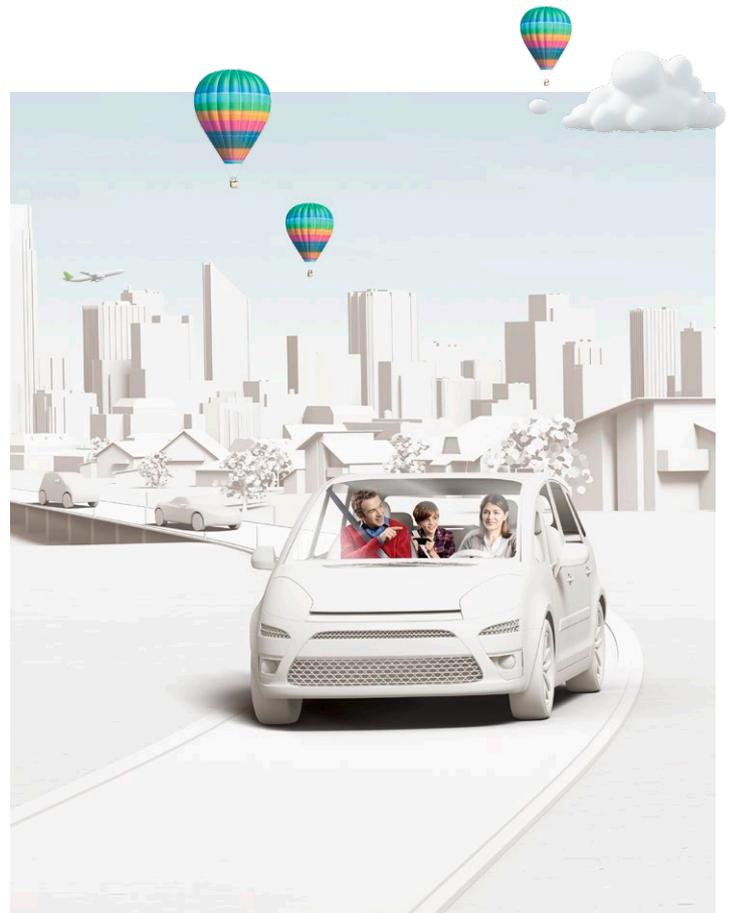
SSD is diagnosed when someone has at least one of the following. [Baguley et al, 2006]

- A difference of at least 30 dB in hearing thresholds between ears.
- Significant differences between ears for speech recognition at the most comfortable level either in quiet or noise.
- Differences between ears in sound tolerance (due to either loudness or distortion).

Causes of SSD include sudden sensorineural hearing loss, surgery and the inner ear condition, Ménière's disease. [Douglas et al, 2007]

There is some evidence that late-onset SSD in teenagers and adults can result in neurological changes in the brain. [Ponton et al, 2001; Tschop et al, 2000; Vasama et al, 1995] The pattern of auditory-evoked potentials in the auditory cortex begins to change within months of the onset of SSD, and continues to change for at least two years. [Ponton et al, 2001]

SSD can cause the brain to change how it processes sound as a result of monaural deprivation



Effects of SSD

People suffering SSD frequently experience a variety of problems in everyday life as a result of their hearing impairment.

- Difficulties hearing conversation in noisy environments (busy streets, restaurants, classrooms etc), particularly when the other person is on the non-hearing side. [Douglas et al, 2007; Noh and Park, 2012]
- Problems localising unseen sound sources, such as those behind the hearer (traffic, pedestrians etc). [Douglas et al, 2007]
- Increased listening effort, a common feature of hearing loss in general. [Douglas et al, 2007]

These result from the **head shadow effect**, in which the loss of binaural hearing makes it difficult for the hearer to distinguish between the signal and background noise. [Pumford, 2005]

Managing SSD

- Usually, correcting hearing loss aims at amplifying sound to overcome impairment in both ears.
- In SSD, the goal is different: it is to transfer sound at a normal level from the impaired ear to the hearing ear. [Pumford, 2005]
- Correcting SSD aims to eliminate the head shadow effect rather than increase sound levels, leading to an increase in the overall signal-to-noise ratio. [Pumford, 2005]

The goal of SSD correction is to eliminate the head shadow effect, not to amplify the signal [Pumford, 2005]

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I have lost 100% of my hearing in the left ear after a tumor surgery.

I slowly began to notice how my hearing loss was increasingly affecting my daily functioning. I found myself withdrawing from any social situations outside of my home where I couldn't control the ambient noise level. The simple act

of conversing with my wife or son in a moving car or outdoor environments had become extremely difficult and frustrating. As a result, I found myself becoming more and more reclusive. In my practice, I found myself struggling to hear patients during their examination. I frequently had to ask them to repeat themselves or turn my head awkwardly; I felt more like the patient than the doctor.

One of my childhood friends, an audiologist, advised me of the CROS months after my surgery upon learning of my difficulties. I met with my local audiologist and a few days later, I was back in her office for my CROS fitting. She walked to my left side and whispered a few words, and I literally began to feel tears well up in my eyes as I heard every word she was saying crystal clear for the first time since my surgery.

To say that the CROS has changed my life would be a gross understatement. I finally have the confidence to actually live my life again. I now gladly say yes to dinners in restaurants, take my son to sporting events, practice medicine and pretty much do everything I would like to do with confidence. I've literally and figuratively been given a second chance at life. Finding out that I had a brain tumor was one of the worst days of my life; finding out that the CROS could help me was one of the best.

Correcting SSD: CROS vs BAHA

- There are two main options to correct SSD where one ear is aidable: bone-anchored hearing aids (BAHAs) and contralateral routing of signals (CROS). Both technologies have evolved over recent years and improve hearing and spatial recognition equally. [Finbow, 2014; Finbow et al, 2015; Kuk et al, 2014; Phonak, 2011]
- Bone-anchored hearing aids (BAHAs) comprise an implanted microphone and sound processor behind the non-hearing ear that sends a signal via bones in the skull to the functioning ear. BAHAs are associated with a number of issues.
 - Requirement for surgery under anaesthesia followed by a 6- to 8-week wound-healing period.[Arnold et al, 2011]
 - Skin reactions require local or systemic treatment and adipose patients are at particular risk of post-surgical soft tissue reactions. [Rebol, 2015]
- BAHAs are expensive compared to conventional hearing aid technology. [Johnson et al, 2006; Ryu et al, 2014].
- Not all subjects with SSD are suitable for a BAHA. For example, people with sensorineural hearing loss may not response of even experience worse performance after being fitted with a BAHA. [Grantham et al, 2012].
- Also, the benefits of BAHAs are determined by the individual's level of transcranial attenuation, so that some people simply will not be able to benefit from having a BAHA fitted. [Stenfelt, 2005]
- Contralateral routing of signals (CROS) comprises a CROS device fitted to the impaired ear, sending a signal to a hearing aid fitted to the functioning ear (Figure 1). [Kuk et al, 2014]
 - Fitting a CROS system avoids the risks and delays of surgery. [Finbow et al, 2015; Ryu et al, 2014]

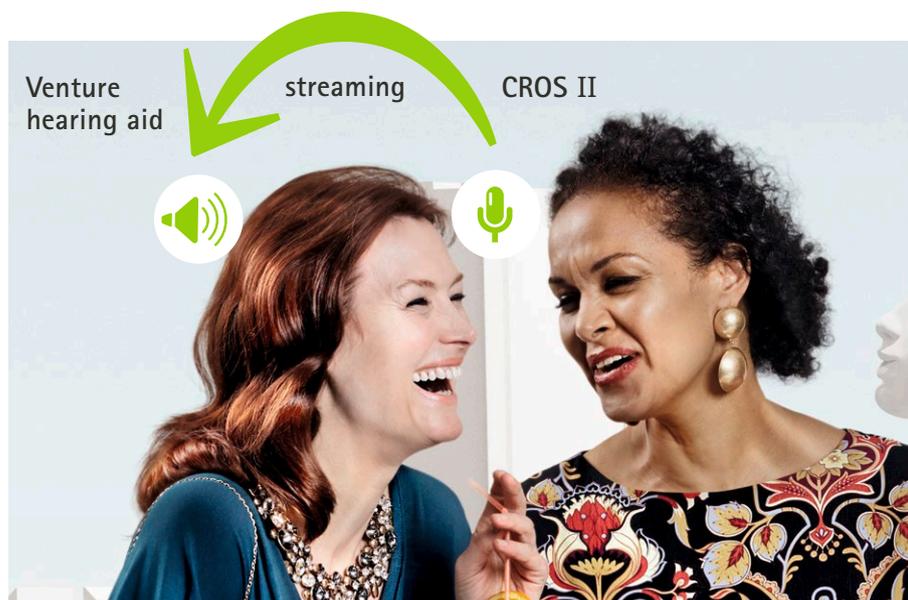


Figure 1. Phonak CROS II: The smart solution for single-sided deafness. A CROS device fitted to the impaired ear sends a signal to the hearing aid fitted to the functioning ear. [Kuk et al, 2014; Phonak, 2011]

CROS II: the new first choice for SSD

Phonak's wireless CROS II models have been developed using state-of-the-art Venture technology to offer optimal support and choice for people with SSD.

- Improved signal-to-noise ratios.
- Good audiological performance in both quiet and noisy situations (see next page).
- Ease of fitting.
- Small, comfortable devices that are almost invisible.
- Battery life up to a third longer than the previous model.
- Choice of model features and colours to suit the wearer.

CROS II has been developed to overcome problems with earlier CROS devices, in particular noise-related issues and

fitting difficulties that impaired performance. [Courtois and Jensen, 1976; Ericson et al, 1988; Gelfand and Silman, 1981] CROS II has a unique set of features that helps overcome the problems associated with head shadow in SSD.

- Automatically detects the listening situation and adjusts to the best possible setting.
- Automatic and/or manual StereoZoom allows a focus on the speaker to improve speech understanding, even in noisy situations.
- Automatic and manual volume control to suit individual preferences.



iCube II fitting device



CROS II Hook for CROS II-13 only

Easy to fit

We recognize that you may not be performing a CROS fitting weekly. But do not worry, the streamlined fitting process of a Phonak CROS II system is as easy and intuitive as a binaural fit.



Go to phonakpro.com/cros to see how simple it is to fit.

Easy to demonstrate

When using iCube II, Phonak CROS II is active during the fitting. Your clients can **instantly experience the benefits** of the CROS solution and provide feedback during the fitting session.

Easy to secure

The CROS II can be fit in many configurations to meet the needs of your client. From the security of a tonehook-earmold combination to the sleek yet secure design of the custom CROS Tip, Phonak has the solution.



Impact of CROS II on SSD

The development of digital, wireless CROS systems has helped improve the general performance of CROS systems. Trials of various digital, wireless systems have repeatedly demonstrated: [Kuk et al, 2014; Phonak, 2011; Ryu et al, 2014; Schafer et al, 2013]

- Good signal-to-noise ratios
- Improved speech recognition in noise and quiet
- Increased ease of communication
- Better cosmetic acceptability
- Greater comfort levels

CROS devices are generally at least as effective as BAHAs at overcoming the hearing deficit. [Finbow et al, 2015] New CROS devices may even perform across a greater range of sound frequencies compared with BAHAs. [Finbow, 2014]

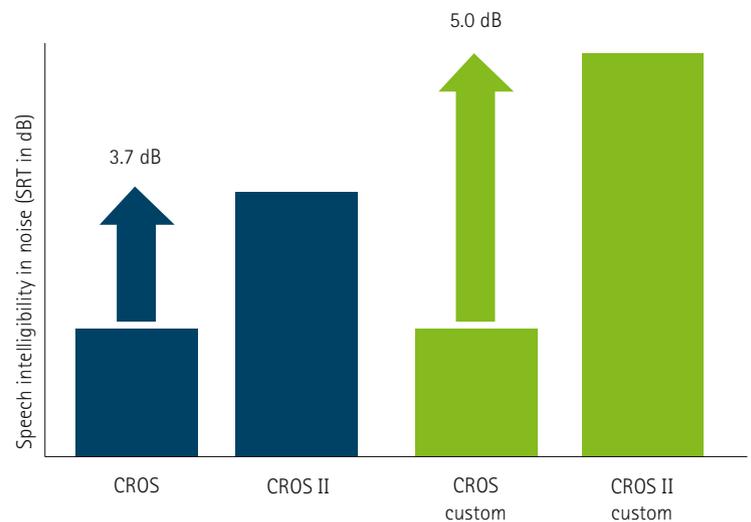
Phonak has undertaken extensive testing and validation of the CROS II system. [Phonak, 2011]

- Subjects with SSD fitted with the CROS II device experienced improved speech recognition in both noisy and quiet environments.
- Comparing CROS to the new CROS II, the signal-to-noise ratio was improved by at least 3 dB. And by up to 5 dB comparing CROS Custom to CROS II Custom. (Figure 2)
- Loudness and sound quality were well accepted.
- The features and functions of CROS II were well received by the wearers.



Objective efficacy	e.g. streaming capacity from the impaired ear to the aided one, speech perception in both quiet and noise, sound localisation
Subjective acceptability	e.g. satisfaction with audibility, ease of handling and overall impression).

Table 1. Latest CROS models, such as Phonak's CROS II, have high levels of efficacy and acceptability. [Ryu et al, 2014; Phonak, 2011]



What do the experts and users say?



Experts recommend CROS as a first step in managing SSD (Figure 3). [Finbow et al, 2015; Ryu et al, 2014]

“My CROS hearing aids gave me back sound and they gave me back my life.”

Angie Aspinall, Phonak CROS wearer

“Wireless CROS provided increased satisfaction and overall improvement of localization and hearing.” Ryu et al, 2014

“As the CROS hearing aid is the least expensive and easiest method for rehabilitation without surgery, it remains the first-step approach.” Ryu et al, 2014

“... with the CROS avoiding the risks of surgery ... we recommend a trial of CROS in our center for first line treatment of single-sided deafness.” Finbow et al, 2015

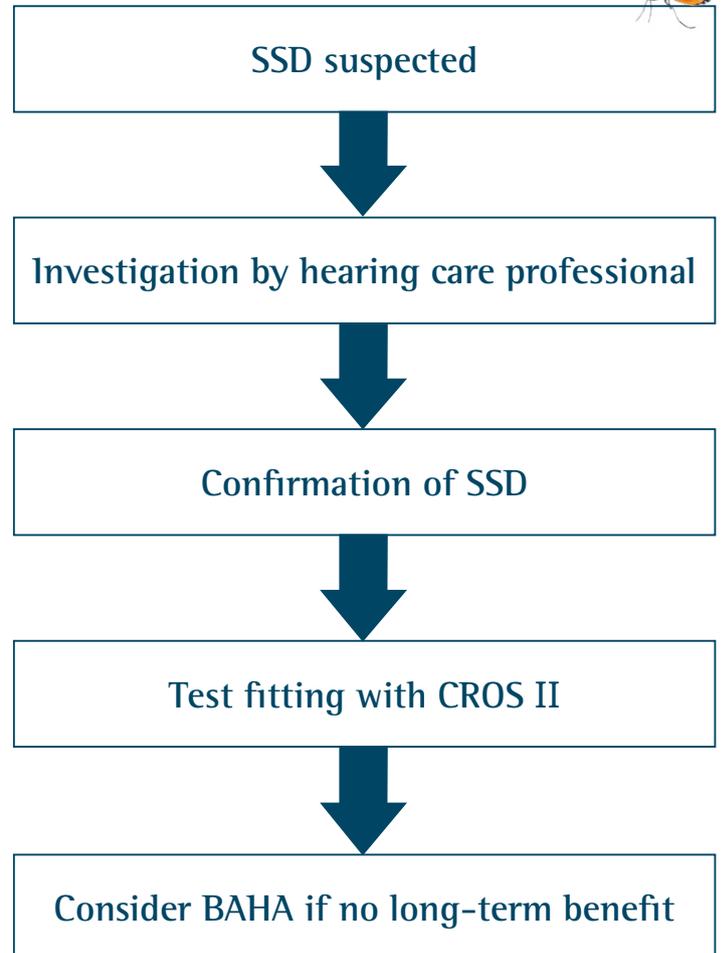


Figure 3. Hearing care experts recommend a trial with new CROS technology such as CROS II before considering the surgical methods such as BAHA. [Finbow et al, 2015; Ryu et al, 2014]

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Life is on

We are sensitive to the needs of everyone who depends on our knowledge, ideas and care. And by creatively challenging the limits of technology, we develop innovations that help people hear, understand and experience more of life's rich soundscapes.

**Interact freely. Communicate with confidence.
Live without limit. Life is on.**

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