CIICA Summary of Research on the effect of CIs on tinnitus

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Background

In the scientific community, tinnitus is defined as the perception of sound in the ears or in the head without an external stimulus. It is reported in 10–15% of the general adult population, and the prevalence increases with age. Tinnitus does not only vary in terms of sound perception and location but also in terms of distress. Some people are not bothered by tinnitus at all, whereas others experience it as bothersome and debilitating. Up to 3% of the general population experience severe and bothersome tinnitus resulting in a substantial reduction in their quality of life.

Hearing impairment is the most common factor associated with an increased risk of having tinnitus. Amongst CI candidates, people reporting tinnitus before implantation ranges from 52 to 86%. The CI primarily aims to partially restore hearing by providing electrical stimulation to the auditory nerve. Tinnitus reduction can be experienced as a beneficial secondary effect of the electrical stimulation after cochlear implantation. While some studies showed that tinnitus loudness, distress or annoyance can be reduced or suppressed after cochlear implantation, others reported that tinnitus can also be worsened in up to 10% of CI recipients or induced in up to 4% of patients receiving a CI.

As the prevalence of tinnitus is relatively high in CI candidates and the effect of cochlear implantation on tinnitus distress seems to vary widely between patients, it is of clinical importance to further investigate the impact of tinnitus on CI recipients and how it might influence hearing performance with a CI. The research summary below provides an overview of the current literature on the effect of CI on tinnitus.

Effect of CI on tinnitus in patients with bilateral hearing loss

Assouly KKS, Smit AL, Eikelboom RH, Sucher C, Atlas M, Stokroos RJ, Stegeman I. Analysis of a Cochlear Implant Database: Changes in Tinnitus Prevalence and Distress After Cochlear Implantation. Trends Hear. 2022 Jan-Dec;26.

Assouly et al. estimated the distress of tinnitus pre- and post-cochlear implantation in 300 patients with bilateral severe to profound hearing loss. This retrospective study analysed pre- and post-cochlear implantation data from 300 CI recipients. Tinnitus prevalence was 55.8% pre-operatively and 44.3% post-implantation. Among the 96 patients experiencing tinnitus pre-implantation, 14.6% patients experienced moderate to catastrophic tinnitus distress pre-implantation compared to 6.3% post-implantation. Tinnitus distress decreased significantly post-implantation. Different changes in tinnitus-related distress were observed: tinnitus suppression, clinically significant tinnitus reduction, no clinically significant change and worsening (i.e. worsening of tinnitus distress or induction of tinnitus) (see illustration below).

Key insights: Tinnitus prevalence and distress decreased significantly post-implantation. Of the 300 CI recipients, approximately 70% reported positive changes, 30% reported no clinically significant changes in their tinnitus and 10% reported negative changes. Although not well studied, these figures are consistent with the current literature. Currently, in patients with bilateral hearing loss, we are unable to predict who will and who will not benefit from CI for tinnitus relief. Further investment in research are needed to understand the factors that influence changes in tinnitus distress and .

The full publication can be accessed here: https://doi.org/10.1177/23312165221128431

Effect of CI in patients with severe tinnitus

Assouly KKS, van Heteren JAA, Stokroos RJ, Stegeman I, Smit AL. Cochlear implantation for patients with tinnitus - A systematic review. Prog Brain Res. 2021;260:27-50.

Assouly et al. systematically reviewed the literature to assess the effectiveness of the CI in patients with tinnitus as a primary complaint (defined as severe or incapacitating distress levels). The authors included seven studies, involving a total 105 subjects. All tinnitus patients in the included studies had asymmetrical hearing loss or single-sided deafness. This is a restricted population which cannot be extended to all hearing-impaired profiles. All included studies had relatively small sample sizes and some deviated from standard cochlear implantation, using a specific fitting or additional sound for a period of time. Most importantly, a statistically significant improvement in tinnitus-related distress, based on the results of the tinnitus questionnaire, was found in all studies.

Key insights: This systematic review shows that CI has a positive effect on tinnitus for patients with severe tinnitus and accompanying asymmetrical hearing loss or single-sided deafness. However, nothing can be concluded for patients with severe tinnitus and bilateral hearing loss, as no study has evaluated the effect of CI in patients with severe tinnitus and bilateral hearing loss.

The abstract can be accessed here: https://doi.org/10.1016/bs.pbr.2020.06.013

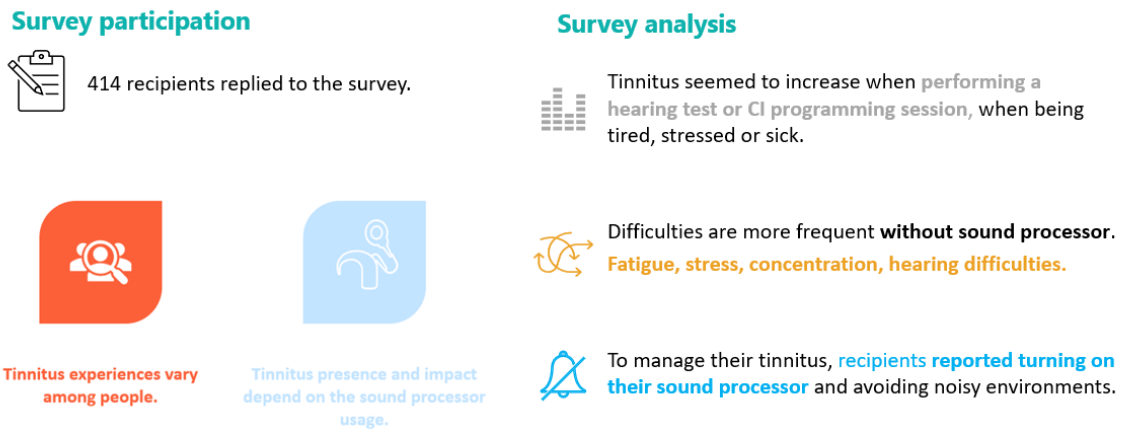
Impact of tinnitus on CI recipients

Assouly KKS, Shabbir M, van Dijk B, Hoare DJ, Akeroyd MA, Stokroos RJ, Stegeman I, Smit AL. The impact of tinnitus on adult cochlear implant recipients: A mixed-method approach. PLoS One. 2023 Apr 20;18(4):e0284719.

Tinnitus is a common problem in patients with a CI. However, apart from handicap scores, little is known about the real-life impact tinnitus has on those with CIs. To better understand how tinnitus impacts CI users in their everyday life, Assouly et al. conducted a web-based forum and shared a developed survey in a Cochlear Ltd.'s online platform, Cochlear Conversation. Participants were adult CI recipients experiencing tinnitus who received a Cochlear Ltd. CI after 18 years of age. After the tinnitus discussion forum was closed, the authors analysed the content of the discussion and extracted the themes and sub-themes. Four key themes were identified using thematic analysis of the discussion forum: tinnitus experience, situations impacting tinnitus, difficulties associated with tinnitus and tinnitus management. To quantify these themes, a survey was developed in English, then translated and disseminated on the platform, in six countries. Among the 414 participants of the survey, tinnitus burden on average was a moderate problem without their sound processor and not a problem with the sound processor on. Fatigue, stress, concentration, group conversation and hearing difficulties were the most frequently reported difficulties and was reported to intensify when not wearing the sound processor. For most CI recipients, tinnitus seemed to increase when performing a hearing test, during a CI programming session, or when tired, stressed, or sick. To manage their tinnitus, participants reported turning on their sound processor and avoiding noisy environments.

Key insights: This study shows that tinnitus can affect everyday life of CI recipients in various ways and highlighted the heterogeneity in their tinnitus experiences. The survey findings extended this to show that tinnitus impact, related difficulties, and management strategies often depend on sound processor use. It is important that these specific needs and the difficulties associated with tinnitus are better recognised by the public and healthcare system to ensure better understanding and better care for CI users suffering from tinnitus.

The full publication can be accessed here: https://doi.org/10.1371/journal.pone.0284719



Influence of tinnitus on hearing related quality of life in CI recipients

Assouly KKS, Arts RAGJ, Graham PL, van Dijk B, James CJ. Influence of tinnitus annoyance on hearing-related quality of life in cochlear implant recipients. Sci Rep. 2022 Aug 24;12(1):14423.

There is no clear evidence of the influence of tinnitus on hearing-related quality of life (QoL) in this population. Assouly et al. assessed the relationship between hearing-related QoL measured by the Speech, Spatial and Qualities of Hearing scale (SSQ12) and perceived change in tinnitus annoyance after cochlear implantation. Data from 2322 implanted adults one year or more post-implantation were analysed. Recipients with tinnitus reported lower hearing-related QoL than recipients without tinnitus. Overall, CI recipients who experienced less bothersome tinnitus reported better hearing-related QoL.

Key insights: This study highlights the negative influence of bothersome tinnitus in hearing-related QoL. More research is needed to know whether tinnitus annoyance has a direct impact on CI performance such as speech recognition. The influence of tinnitus on the hearing-related quality of life of CI recipients suffering from tinnitus should be more clearly highlighted and recognised by the public and the healthcare system, which should encourage the development of appropriate solutions.

The full publication can be accessed here: https://doi.org/10.1038/s41598-022-18823-3