Acta Scientific Otolaryngology (ISSN: 2582-5550)

Volume 4 Issue 10 October 2022

Case Report

Subjective Preference of Bilateral Cochlear Implant User Using Devices Manufactured by Two Different Cochlear Implant Companies

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DOI: 10.31080/ASOL.2022.04.493

Received: July 20, 2022

Published: September 14, 2022

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Abstract

When evaluating the differences between devices from different cochlear implant (CI) manufacturers, there are few reports on patients implanted with bilateral CIs from two different CI manufacturers.

This case study reports on a paediatric CI recipient implanted bilaterally with devices from two different CI manufacturers.

According to pre-operative imaging there were no pathological findings. CI surgery was performed according to the manufacturer's instruction for use. Post-operative CT imaging confirmed that the electrodes were placed correctly inside the cochlea. Despite these findings, the subject had a subjective preference for their MED-EL CI device.

Bilateral CI is becoming common and information from patients implanted bilaterally with bi-brands should be brought together to ascertain the compatibility of these devices and implications of bi-brand use.

Keywords: Children with Cochlear Implants; Cochlear Implantation; Deafness; Hearing Loss; Perception; Reimplantation

Main Points

- Bilateral CI is more common and information on the compatibility of devices from different manufactures of cochlear implants is important for the best outcome for the patient.
- Subjective preference plays an increasing important role in the CI patient's use.
- When evaluating the differences between devices from different CI manufacturers, we must consider that there are multiple factors at play that can affect differences in the objective outcomes reported.

Introduction

Bilateral cochlear implantation offers the advantage of better localization of sound, hearing in noise, and overall loudness perception [1]. There are very few reports on the subjective preference of bilateral cochlear implant (CI) users using devices from two different CI brands [2,3]. To the best of our knowledge this is the third case report of a patient who has had bilateral CIs fitted from two different CI manufacturers, namely: Cochlear Corporation (Sydney, Australia) and MED-EL (Innsbruck, Austria).

Case Presentation

The case presented is of a 12-year old female. She was born deaf and received a CI on the right-side ear at the age of one-and-half years of age following the standard CI surgical technique that involves mastoidectomy, posterior tympanotomy to reach the middle ear space and traditional bony cochleostomy to insert the electrode. The device was from Cochlear Corporation with a Contour Advance (CA) electrode covering an angular insertion depth (AID) of 360°. In 2014, at the age of 5 years, the patient was consulted for implantation on the left side. At that time, the patient had a speech discrimination score of 76% at 20dB loudness, using the right-side CI.

The left side was implanted with a MED-EL CONCERTO implant coupled with a FLEX^{24} electrode, due to the availability of only that device at the clinic at that time of implantation and the patients geographic location meant they were unable to return to the clinic where the implantation was originally performed. The CI surgery was performed following the standard CI surgical technique involving mastoidectomy, posterior tympanotomy to reach the middle ear space and round window entrance to insert the electrode. The Computer Tomography (CT) image after the second side implantation showed the FLEX^{24} electrode with 11 channels inside the cochlea, covering an AID of 360°, similar to the CA electrode on the right side.

A few months after the first fitting of the MED-EL audio processor on the second side, the patient complained of an uncomfortable feeling/headache while hearing both audio processors. The impedance field telemetry from both devices showed normal values in the range of 3-7 kΩ on all the channels; confirming that both devices were functioning properly. At the time we speculated that the headache/discomfort could have been due to the implantation with two different types of device, i.e. her first implantation was with a Cochlear device, while her second side implantation was with a MED-EL device, but the patient had heard well after her first implantation. Thus, during the consultation, the patient was advised to use the audio processor of her preference. In 2017, the parents of the child reported that she preferred to use the audio processor from MED-EL; mainly due to the clarity of the sound. At the time of reporting (Jan2020), the subject is using her left side (MED-EL) audio processor only and is attending mainstream education. The right-side implant is still in place without being explanted or reimplanted.

Informed consent was obtained from the patient for the inclusion of their data in this study.

Discussion and Conclusion

From an anatomical perspective, both the sides were diagnosed with no pathological findings from the pre-operative imaging. Surgically, the standard CI surgical steps were applied, and the CI devices were implanted following the CI companies' instruction for use. The post-operative CT imaging confirmed the proper placement of the electrodes inside the cochlea.

The 3 main differences between CA and FLEX^{24} electrode are the proximity of the electrode channels to the central modiolus trunk, the contact separation distance between the individual contacts, and the number of independent stimulation channels. The post-operative image given in figure 1, though has high metallic artefact on the right side, it shows that the CA electrode is away from the outer wall; whereas the FLEX^{24} follows the outer wall from the base to the apex.

Figure 1: Coronal view of the temporal bone showing Contour Advance (CA) electrode on the right side and FLEX24 electrode on the left side. CA has 22 independent stimulating channels close to each other with a contact spacing of 0.7 mm and FLEX24 electrode has 12 independent stimulating channels with a contact spacing of 1.9 mm.

Furthermore, we can see in the post-operative images that the individual contacts of the CA electrode cannot be visually separated due to the metallic artefact from the closer contact spacing (Figure 1). The CA electrode has 22 independent stimulation channels, whereas the FLEX^{24} electrode has 12 independent stimulation channels. The contact separation distance between the individual channels in the CA electrode is only 0.7mm,which means that the 22

stimulating channels are packed closer to each other; whereas, in the FLEX^{24} electrode the individual contact spacing is 1.9mm,which means that the 12 stimulating channels are well separated.

The uncomfortable feeling the child experienced could also be related to the cross-channel interactions between the individual channels in the CA electrode due to the closer contact spacing, which might not have been the case with the FLEX^{24} electrode because of its wider contact spacing. The central auditory cortex presented with two different electrical stimulation patterns, coming from two different signal processing strategies, could have caused an uncomfortable feeling while the subject is hearing with both audio processors.

There are few reports on patient cases that have bilateral CIs from two different CI manufacturers. Withers., *et al*. was the first to report on the first case of a 63-year-old female implanted with a Cochlear Corporation Nucleus 24k CI24R implant on her left ear and a MED-EL SONATA TI100 implant on her right ear [2]. Later on, in the same year, Harris., *et al*. reported on 6 cases of CI users with bilateral CI from two different CI manufacturers [3]. All the CI users in this study were implanted at first with a Cochlear Corporation Nucleus CI and opted for a MED-EL SONATA TI100 on their sequential side. The six subjects included were aged between 34 and 68 years of age (4 females, 2 males). In both reports, the CI users showed a subjective preference for their MED-EL device. In the second case study, 4 out of the 6 participants preferred their MED-EL device for music appreciation, although there were no statistically significant differences between the devices upon objective testing as reported.

When evaluating the differences between devices from different CI manufacturers, we must consider that there are multiple factors at play that can affect differences in the objective outcomes reported. Such as the etiology of hearing loss, the insertion depth, the number of active electrodes, the contact spacing between individual electrodes, the surgical procedure, and the correct placement of the electrode and non-auditory stimulation [4]. We must also not underestimate the importance of the CI user's subjective perception. Increasing evidence suggests that a CI user's opinion on the quality of the sound they receive is very important [5].

Bilateral CI is becoming common and it is only a matter of time before the unilateral CI users receive their second side CI. Information from patients implanted bilaterally with bi-brands should be brought together to assist in comparison between different CI brands.

Bibliography

1. Litovsky RY., *et al*. "Benefits of bilateral cochlear implants and/or hearing aids in children". *International Journal of Audiology* 45 (2006): S78-91.

2. Withers SJ., *et al*. "Comparison of outcomes in a case of bilateral cochlear implantation using devices manufactured by two different implant companies (Cochlear Corporation and Med-El)". *Cochlear Implants International* 12.2 (2011): 124-126.

3. Harris RL., *et al*. "Intra-individual assessment of speech and music perception in cochlear implant users with contralateral Cochlear™ and MED-EL™ systems". *Acta Otolaryngology* 131.12 (2011): 1270-1278.

4. Anderson TR and Jahromi S. "Selecting medical hardware using pairwise comparisons: A patient's perspective of cochlear implant device selection". 2016. Portland International Conference on Management of Engineering and Technology (PICMET) (2016).

5. Ramakers GGJ., *et al*. "Correlation between subjective and objective hearing tests after unilateral and bilateral cochlear implantation". *BMC Ear Nose and Throat Disorders* 17 (2017): 10.