Evaluating Design Improvements with SONNET 3 in Experienced Cochlear Implant Users

IDE NUMBER G240188

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LIST OF ABBREVIATIONS

ADE	Adverse Device Effect
AE	Adverse Event
AP	Audio Processor
CFR	Code of Federal Regulations
CI	Cochlear Implant
CRF	Case Report Form
CRO	Contract Research Organization
FDA	Food and Drug Administration
GCP	Good Clinical Practice
IC	Informed Consent
IDE	Investigational Device Exemption
IRB	Investigational Review Board
PI	Principal Investigator
SAE	Serious Adverse Event
SAP	Statistical Analysis Plan
SOP	Standard Operating Procedure
UADE	Unanticipated Adverse Device Effect

STATEMENT OF COMPLIANCE

The trial will be conducted in accordance with Good Clinical Practice (GCP), as required by the following:

- United States Code of Federal Regulations (CFR) applicable to clinical studies (21 CFR Part 50, 21 CFR Part 54, 21 CFR Part 56, 21 CFR Part 58, 21 CFR Part 812)
- Good Clinical Practices

All investigators involved in the conduct of this study will be informed about their obligations in meeting the above commitments. The protocol and consent forms will be reviewed and approved by the Institutional Review Board (IRB) before participants are enrolled. Any amendment to the protocol will be reviewed and approved by the IRB before changes are implemented to the study.

1 PROTOCOL SUMMARY

1.1 SYNOPSIS

Title:	Evaluating Design Improvements with SONNET 3 (EAS) in Experienced Cochlear Implant Users
Study Description:	This prospective IDE study will use a single-arm, repeated measures design with subjects serving as their own control. Participants will be experienced cochlear implant (CI) users wearing an approved MED-EL audio processor. The study will demonstrate patient-reported improvement in processor design, usability, and satisfaction with the SONNET 3 (EAS) (EAS) Audio Processor compared to their existing audio processor. Participants will complete a take-home trial with the SONNET 3 (EAS). At Visit 2, participants will complete a custom questionnaire comparing design and usability with SONNET 3 (EAS) (EAS) to their existing audio processor.
Objectives:	Primary Objective: To demonstrate patient-reported improvement in processor design with the SONNET 3 (EAS) (EAS) audio processor compared to the existing audio processor. Secondary Objectives: To compare user experience with the SONNET 3 (EAS) (EAS) audio processor to the existing audio processor.
Endpoints:	Primary Endpoint: At least 77% of participants will report improvement (mean score >3 on a 6-point Likert scale) in processor design with the SONNET 3 (EAS) (EAS) compared to the existing audio processor on the Design subsection of the Audio Processor Comparison Survey (APCS) at Visit 2. Secondary Endpoints: 1. Summary of patient-reported satisfaction ratings on subsections of the Audio Processor Comparison Survey (APCS) with SONNET 3 (EAS) (EAS) at Visit 2. 2. Summary of audiologist-reported satisfaction ratings on subsections of the Audiologist Survey at enrollment conclusion.
Study Population:	This study will include 20 experienced MED-EL CI users who are consistently wearing a SONNET (EAS) or SONNET 2 (EAS) audio processor at ≥12 months post-activation and are able to complete the study procedures.
Description of Sites Enrolling Participants:	One (1) US academic medical center will enroll participants
Description of Study Device:	Participants will be experienced MED-EL CI recipients using the commercially available SONNET (EAS) or SONNET 2 (EAS) audio processor (MED-EL Elektromedizinische Geräte GmbH, Innsbruck, Austria). For the experimental procedure, participants will be fit with a SONNET 3 (EAS) (EAS) audio processor (MED-EL Elektromedizinische Geräte GmbH, Innsbruck, Austria). The SONNET 3 (EAS) (EAS) audio processor is an external component and is indicated for use on

	patients who have been implanted with a MED-EL cochlear implant. The SONNET 3 (EAS) (EAS) audio processor consists of the control unit, coil, coil cable, microphone cover, earhook, and battery pack. SONNET 3 (EAS) (EAS) is programmed with the MAESTRO 11.0 or higher Fitting Software (MED-EL Elektromedizinische Geräte GmbH, Innsbruck, Austria).
Study Duration:	Enrollment is expected to take 12 months, and participant follow-up will last up to 1 month. The estimated time from the first subject's first visit to the last subject's last visit is 13 months.
Participant Duration:	Each subject's participation will last approximately 1 month from enrollment to the final study visit.

1.2 SCHEMATIC OF STUDY DESIGN

Visit 1: Enrollment

- Informed consent or assent (if required)
- Parental permission (if applicable)
- Participant leaves with SONNET 3
- **See Study Schedule *(Section 7.2*) and Schedule of Events Table (*Section 7.2.5*) for more detail**

Visit 2: 3-Week Follow Up

- Audio Processor Comparison Survey completed by participant
- **See Study Schedule *(Section 7.2*) and Schedule of Events Table (*Section 7.2.5*) for more detail**

Enrollment Conclusion

- Audiologist Survey completed by study team
- **See Study Schedule *(Section 7.2*) and Schedule of Events Table (*Section 7.2.5*) for more detail**

2 INTRODUCTION

2.1 STUDY RATIONALE

Cochlear implant audio processors capture and deliver acoustic signals to the internal device. They accomplish this through dual-microphone technology and signal processing algorithms developed to preferentially detect and enhance speech signals relative to background noise. The audio processor is worn all waking hours, every day for best outcomes. The requirements of a reliable audio processor are two-fold; reliable performance of signal processing and front-end microphone features ensures clear speech, while a comfortable design reduces barriers to wearing the device all waking hours.

Manufacturers of cochlear implants release periodic updates to processor design to enhance usability and the listening experience. Insurance companies in the United States are typically contracted to subsidize the purchase of new processors every 5 years, depending on the coverage plan and the region. However, insurance providers may deny coverage for new processors without data to support the efficacy of new technology compared to previous processor designs.

2.2 BACKGROUND

The SONNET 3 (EAS) audio processor (AP) is MED-EL's latest BTE design (Innsbruck, Austria) and improves upon the existing SONNET/SONNET 2 (EAS) APs with enhanced physical design and Bluetooth useability. The SONNET 3 (EAS) is programmed with MAESTRO 11 software, both of which have been submitted to the FDA for approval in June 2024 (refer to submission P000025/S131). MAESTRO 11 includes minor improvements in the user interface (see section 6.1.3). The SONNET 3 (EAS) offers a smaller and lighter design for better wearing comfort on the ear (see section 6.1.3). New earhook options, including a large earhook and a flexible silicone earhook designed for improved flexibility on the pinna, allow the recipient to further customize their wearing options. Bluetooth streaming in the SONNET 3 (EAS) is simplified with an integrated 2.4GHz receiver that no longer needs an intermediary device to stream music, phone calls, and other audio from smart devices. These design changes are an answer to the field's request for lighter wearing options with integrated streaming capabilities.

In 2012, Lorens and colleagues compared subjective benefit of a new audio processor (AP) design in a group of 10 experienced electro-acoustic stimulation (EAS) CI recipients who were utilizing the MED-EL DUET AP. Subjects were upgraded to the DUET 2 AP and completed a custom questionnaire at three intervals during a 3-month trial to study the effects of user preference over time. The custom survey compared aspects of user-perceived listening ability and wearing comfort with DUET 2 to the DUET AP. Subjects' preference for the sound quality of speech with DUET 2 improved at each interval, achieving 34% preference over the DUET AP by the 3-month interval. Overall, 70% of subjects were either very satisfied or satisfied with the

wearing comfort of the DUET 2, and no subject was dissatisfied with the wearing comfort of the DUET 2. Results suggest that experience with a new processor is important when measuring subjective impressions of these changes in AP design. The authors concluded that conversion from the old to the new AP model greatly improved patient satisfaction.

In 2015, Martin et al. gathered data from both implant recipients and professionals on the ease of use of the new Naída CI Q70 (Naída CI) AP from Advanced Bionics, and on the usefulness of the new functions and features available. Existing CI users who had recently upgraded to Naida CI answered a 25-question custom survey which included a section directly comparing the user's previous AP to the Naida CI AP. Feedback from professionals was captured through a 30-question survey probing their impressions on usability and fitting. In total, 186 subjects across 10 countries, and 23 professionals across 11 sites responded to the survey. The Naida CI was rated as similar or better than the previous AP models by more than 79% of the subjects for all areas. The new design of the Naida CI was rated as being better by 83% of subjects. Professionals ranked the Naida CI processor first in design compared to other previous models. Overall results showed high satisfaction with the new AP from users of all ages and experience levels, as well as from professionals.

Warren et al., 2019 compared subjective impressions of experienced Cochlear brand Nucleus 5 and Nucleus 6 AP users who trialed the Nucleus 7 AP. Comparative satisfaction with self-reported hearing ability and usability with the new AP was captured via a custom survey after 3 months using the device. The majority of subjects reported improvement in perceived hearing ability and device usability with the new AP design compared to their existing audio processor, with an average of 83% of participants (n=35) responding positively (>50 on a 100-point scale) to questions comparing features of the new AP to the existing model. The authors conclude that the assessment of effectiveness of ergonomic improvements in AP design are best captured through subjective evaluation after providing the user with adequate time and experience with the device to assess the comparative benefits to their previous device.

The purpose of this study is to evaluate patient-reported improvement in design and comfort with SONNET 3 (EAS) over the existing AP models available, and to measure patient-reported impressions of usability and satisfaction with the SONNET 3 (EAS) AP.

2.3 RISK/BENEFIT ASSESSMENT

2.3.1 KNOWN POTENTIAL RISKS

Any cochlear implant processor poses a risk of skin irritation or sensitivity to the processor materials. Materials in the SONNET 3 (EAS) (EAS) Audio Processor do not differ from those in the FDA-approved SONNET/SONNET 2 (EAS) Audio Processors. MED-EL has performed biological safety and compatibility testing with materials in the SONNET 3 (EAS) (EAS), and subjects with a skin or scalp condition that would preclude use of the audio processor will be excluded from this study. All cochlear implant processors and fitting software also pose a risk of overstimulation

and exposure to unwanted or uncomfortable sounds. The processor can be removed from the head at any time to immediately stop stimulation.

There is a remote chance that technical failure or suboptimal fitting of any audio processor leads to unwanted sensations, missing information, suboptimal hearing, or lack of benefit. Study participants who wish to stop using the SONNET 3 (EAS) (EAS) Audio Processor before study completion may withdraw from the study at any time and continue using their existing audio processor. Participants who experience poorer sound quality or performance with SONNET 3 (EAS) (EAS) may be reprogrammed after testing at Visit 2.

2.3.2 KNOWN POTENTIAL BENEFITS

Advances in audio processor design may provide improved wearing comfort, usability, satisfaction, and durability with the SONNET 3 (EAS) (EAS) Audio Processor. This study will evaluate potential benefits to inform future device labeling, insurance coverage, clinical guidance, and product development for all MED-EL cochlear implant users. After completing Visit 2, study participants may choose to keep the SONNET 3 (EAS) (EAS) Audio Processor or return the SONNET 3 (EAS) (EAS) and continue using their existing audio processor.

2.2.3 ASSESSMENT OF KNOWN POTENTIAL RISKS AND BENEFITS

This study will include experienced MED-EL CI users who have worn an FDA-approved SONNET (EAS) or SONNET 2 (EAS) Audio Processor (P000025/S078 and P000025/S112, respectively) for at least 12 months. The SONNET/SONNET 2 (EAS) Audio Processors (AP) are part of the MED-EL Cochlear Implant System (P000025). The SONNET 3 (EAS) (EAS) AP is not expected to pose any greater risk of harm to participants than SONNET/SONNET 2 (EAS) APs. Advances in technology with SONNET 3 (EAS) (EAS) may provide new design features to improve wearing comfort and streamlined connectivity to improve usability. Thus, the benefits of SONNET 3 (EAS) (EAS) are expected to outweigh the residual risk in this population. Periodic advances in audio processor technology are standard practice and expected in the field of cochlear implants. This study in intended to collect clinical data on patient-reported satisfaction and performance with SONNET 3 (EAS) (EAS) before commercial availability in the United States to assist with future product launch and insurance coverage.

3 OBJECTIVES AND ENDPOINTS

OBJECTIVES	ENDPOINTS	JUSTIFICATION FOR ENDPOINTS
Primary		
To demonstrate patient-reported improvement in processor design with the SONNET 3 (EAS) (EAS) Audio Processor (AP) compared to the existing AP.	At least 77% of participants will report improvement in processor design with SONNET 3 (EAS) (EAS) compared to the existing AP on the Design subsection of the Audio Processor Comparison Survey (APCS) at Visit 2.	Based on changes in size, weight, and earhook, we expect the majority of users to report improved design with SONNET 3 (EAS). Warren et al., 2019[1] compared useability of a novel AP to the existing design and found that, 77% of participants reported improvement in design. A mean score >3 (6-point Likert scale) on the APCS Design subsection will indicate agreement with improved design of SONNET 3 (EAS).
Secondary		
To compare user experience with the SONNET 3 (EAS) (EAS) Audio Processor to the existing AP.	Summary of patient-reported satisfaction ratings (6-point Likert scale) on subsections of the APCS with SONNET 3 (EAS) (EAS) at Visit 2.	The APCS includes the Bluetooth Pairing, Backwards Compatibility, and Parent Impressions subsections to assess different areas of SONNET 3 (EAS) (EAS) usability.
	Summary of audiologist-reported satisfaction ratings on subsections of the Audiologist Survey at enrollment conclusion.	The Audiologist Survey assesses the clinician perspective on usability improvements with SONNET 3 (EAS) (EAS).

4 STUDY DESIGN

4.1 OVERALL STUDY DESIGN

This prospective, single-site IDE study uses an open-label, single-arm, repeated-measures design with participants serving as their own control. One US academic medical center will enroll 20 experienced MED-EL CI users to evaluate the design and usability of the SONNET 3 (EAS) Audio Processor (AP). Participants may enroll before or at Visit 1. Each participant will complete a 3-week trial with the SONNET 3 (EAS) AP. Participants will return 2-4 weeks after Visit 1 to complete a custom survey comparing AP design (Visit 2). Study objectives will assess patient-reported improvement in AP design and compare usability with the SONNET 3 (EAS) AP to participants' existing SONNET (EAS) or SONNET 2 (EAS) AP. The primary endpoint will demonstrate superiority of the SONNET 3 (EAS) AP design compared to the existing AP designs.

4.2 SCIENTIFIC RATIONALE FOR STUDY DESIGN

Randomization is not appropriate for this study. A repeated-measures, within-participant design using participants as their own control enables clinically meaningful comparisons that account for patient heterogeneity.

4.3 END OF STUDY DEFINITION

An individual's participation is considered complete when the participant completes the last visit, or the last procedure shown in the Schedule of Events Table in *7.2.5.*

5 STUDY ENROLLMENT AND WITHDRAWAL

5.1 PARTICIPANT INCLUSION CRITERIA

Participants must meet all inclusion criteria below:

- Implanted with a MED-EL cochlear implant in at least one ear
- ≥ 12 months since activation of the MED-EL audio processor
- Consistently using a SONNET (EAS) or SONNET 2 (EAS) Audio Processor
- Ability to complete all study procedures
- Participant and parental (if applicable) commitment to comply with all study procedures for the duration of the study

5.2 PARTICIPANT EXCLUSION CRITERIA

Participants must not meet any exclusion criteria below:

- Evidence that hearing loss is retrocochlear in origin

- Unable to provide reliable feedback during cochlear implant programming
- Skin or scalp condition precluding use of the SONNET 3 (EAS) Audio Processor
- Unrealistic participant or parent (if applicable) motivation or expectations
- Participants without a stable fitting map at enrollment e.g., due to changes in hearing, global health status, etc.

5.3 STRATEGIES FOR RECRUITMENT AND RETENTION

The current study aims to enroll 20 participants. Potential participants will be recruited through the outpatient clinics at a single academic medical center. The site may review existing records for patients to determine potential participants. Participants may also be recruited by their clinical audiologists, who will refer the potential participant to the clinical research team to verify candidacy. Parents or legal guardians must provide permission for participants under 18 years of age to participate. The IRB will determine needs and age required for assent. Parental/guardian permission and assent must be explained and signed before enrollment testing.

5.4 PARTICIPANT WITHDRAWAL OR TERMINATION

5.4.1 REASONS FOR WITHDRAWAL OR TERMINATION

Participants or their parents/legal guardians may choose to withdraw from the study at any point during participation. The site principal investigator may terminate an individual's participation in the study for reasons outlined below:

- Noncompliance with the study protocol
- Health concerns that prevent required follow-up procedures or interval visits

The site investigators should report participant withdrawals and terminations to study monitors as soon as possible. Subjects who withdraw prior to completion of Visit 2 will be required to return the SONNET 3 (EAS) Audio Processor to receive compensation for Visit 1. Participants who are considered lost-to-follow-up should also be reported to study monitors immediately. Every effort should be made to contact participants lost-to-follow-up and determine the reason for noncompliance. If the SONNET 3 (EAS) is not returned, the subject's clinical audiologist will be made aware so that efforts can be made to retrieve the study device at a clinical follow-up appointment.

5.4.2 HANDLING OF PARTICIPANT WITHDRAWALS OR TERMINATION

Withdrawn participants will continue to be seen by their clinical audiologist for regular follow-up care, but no additional data will be collected. Participants who sign the informed consent/assent form but do not complete all study intervals may be replaced and will return any study equipment to the site. Baseline data collected on withdrawn subjects who are replaced will not be included in the modified intent-to-treat (mITT) or per population (PP) analysis datasets.

6 STUDY DEVICE

6.1 STUDY DEVICE DESCRIPTION

6.1.1 CLASSIFICATION

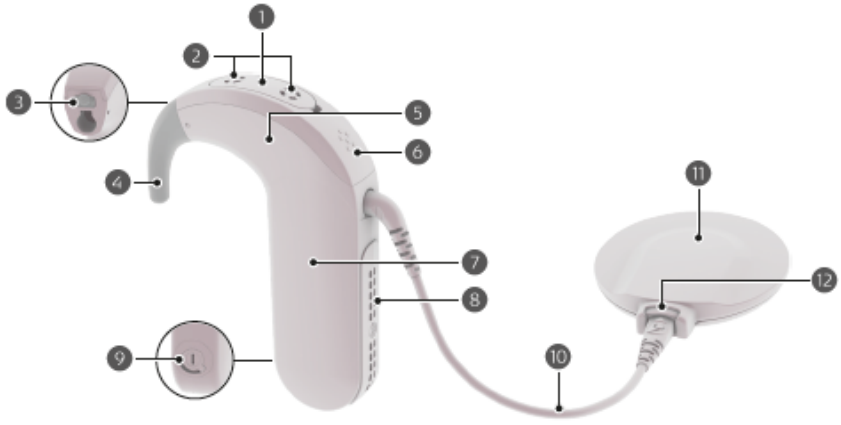
The SONNET 3 (EAS) Audio Processor is an external component intended for use with the MED-EL Cochlear Implant System, a class III medical device (P000025). All study participants will be experienced MED-EL CI users who have been wearing an FDA-approved SONNET (EAS) or SONNET 2 (EAS) Audio Processor (P000025/S078 and P000025/S112, respectively) for at least 12 months. Details of the SONNET 3 (EAS) classification can be located in the FDA submission P000025/S131 (June 28, 2024).

6.1.2 DETAILS OF MANUFACTURER

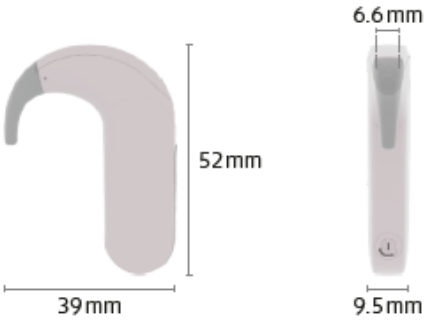
The SONNET 3 (EAS) Audio Processor is manufactured by MED-EL Elektromedizinische Geräte GmbH. MED-EL Corporation is the US importer and the sponsor of this clinical trial.

6.1.3 GENERAL DESCRIPTION

The SONNET 3 (EAS) is a cochlear implant audio processor designed to capture and transmit acoustic sound to the surgically implanted internal device. The SONNET 3 (EAS) is designed to be worn behind the ear and is comprised of the control unit, battery pack, earhook, microphone cover, DL-Coil, coil cable, and magnet (see diagram from SONNET 3 (EAS)/SONNET 3 (EAS) EAS User Manual[3] below).



The SONNET 3 (EAS) is the third generation SONNET processor. It improves upon the previous generations in earhook design, size, and Bluetooth streaming capability. The SONNET 3 (EAS) is lighter in weight (SONNET/SONNET 2: 10.6 g) and shorter (SONNET/SONNET 2: 56.7 mm) than SONNET/SONNET 2 (see SONNET 3 (EAS)[3] specifications below).

Dimensions[11]	
Weight[11]	SONNET 3 for CI: 9.5 g (including 2 zinc-air batteries) SONNET 3 EAS: 9.9 g (including 2 zinc-air batteries)

The SONNET 3 (EAS) has more earhook options, including a flexible silicone earhook and a large earhook to accommodate different pinna sizes. Status indicator lights are visible through the earhook, making viewing easier for users and guardians (see below).

The microphone cover is smaller and designed with an easier mechanism for replacement (see below).

The new touch key feature gives users the ability to adjust program or activate ‘Standby Mode’ simply by tapping the audio processor.

The audio processor is equipped with 2.4 GHz Bluetooth® [6] wireless technology. This technology allows the audio processor to connect to certain mobile devices wirelessly (smartphone, tablet, etc.).

The SONNET 3 (EAS) processor is intended for use in patients who have been implanted with a MED-EL cochlear implant (SYNCHRONY/SYNCHRONY 2 (PIN), SONATA, MED-EL CONCERT, PULSAR, COMBI40/COMBI40+).

The SONNET 3 (EAS) Audio Processor is programmed with MAESTRO System Software 11[4] or higher. MAESTRO 11 builds off of previous versions with the following new features and changes:

- Support the programming of SONNET 3 (EAS) and SONNET 3 (EAS) EAS audio processors
- New user interface for the Configuration options dialog
- New dialog for configuration of audio input options with additional options for programming SONNET 3 (EAS) processors
- Allows the configuration of wireless streaming options for SONNET 3 (EAS)

6.1.4 MECHANISMS OF ACTION

The SONNET 3 (EAS) Audio Processor control unit is programmed using MAESTRO 11 System Software or higher. Once programmed, the control unit is powered via the battery pack and worn on the ear. The control unit captures the acoustic signal via processor microphones, then applies dynamic range compression so that the signal can be converted into electrical output. Maplaw adjustments provide additional gain to the input signal to enhance soft speech before the signal is encoded into electrical pulses. Signal processing algorithms are applied to the speech signal, which is converted into an electrical signal and transmitted via the cable-coil to the internal device for auditory sensation.

6.2 STUDY DEVICE CONTROL

6.2.1 ACQUISITION

MED-EL Corporation will provide MAESTRO 11 or higher software and the necessary Activation Key to the site on a standalone laptop via a loaner agreement for study purposes. MED-EL will also provide an allotment of SONNET 3 (EAS) audio processors to the site via a loaner agreement. The site will notify MED-EL of the assigned processor serial number associated with

each participant. At the conclusion of their participation in the study, each participant may choose to keep the SONNET 3 (EAS), at which time the audio processor warranty will be registered and activated in accordance with standard SOPs. When the study is completed, the site will return any unused/returned SONNET 3 (EAS) audio processors and the loaner laptop to MED-EL.

6.2.2 LABELING

Outer packaging on study devices will be labeled with stickers that read: "CAUTION - Investigational Device. Limited by Federal (or United States) law to investigational use."

6.2.3 STORAGE

The study site should store devices labeled for investigational use separately from approved devices for non-study patients. There are no additional requirements for storage of the device.

6.2.4 ACCOUNTABILITY

MED-EL will be responsible for creating and storing records related to device accountability and traceability. Shipment records, including name and address of the study site, participant ID, device information, date of shipment, and serial numbers, will be stored at MED-EL according to the relevant SOPs. Study devices returned to MED-EL will be documented and stored accordingly.

7 STUDY PROCEDURES AND SCHEDULE

7.1 STUDY PROCEDURES

7.1.1 STUDY SPECIFIC PROCEDURES

The following procedures will be performed during the study and will be documented for each participant enrolled:

- Informed consent: Site study personnel will review the IC form with potential participants and obtain signature prior to initiating study activities. Participants will be allowed to ask questions and may withdraw consent at any time.
- Parental/Legal Guardian permission: Site study personnel will review the parental permission form with the parents/legal guardians and obtain parental permission before starting study activities. Parents/guardians will be allowed to ask questions and may withdraw consent at any time.
- Assent: If required by the IRB, site study personnel will review the assent form with the potential participant and obtain assent before starting study activities. Potential participants will be allowed to ask questions and may withdraw assent at any time.

- Patient-Reported Outcomes:
    - Audio Processor Comparison Survey (APCS): Participants will complete the APCS at Visit 2. The APCS includes questions arranged into four subsections that assess user or parent satisfaction with design, Bluetooth pairing, and backwards compatibility with the SONNET 3 (EAS) compared to the existing audio processor. Responses are captured with a 6-point Likert scale, and responses from the Design subsection will be analyzed for the primary endpoint. Responses on all other subsections will be summarized for the secondary endpoint.
- Audiologist Outcomes:
    - Audiologist Survey: This custom survey assesses clinician impressions of device usability with SONNET 3 (EAS) compared to the existing models, SONNET/SONNET 2 (EAS). The survey features three subsections and responses are captured with a 6-point Likert scale. This survey will be completed by the audiologists upon conclusion of enrollment.

7.1.2 STUDY INTERVALS

- Visit 1: Enrollment/Baseline
- Visit 2: 3-week Interval (2-4 weeks after Visit 1)
- Enrollment Conclusion

Testing can occur outside of the provided window with prior approval from MED-EL.

7.2 STUDY SCHEDULE

7.2.1 POTENTIAL PARTICIPANT IDENTIFICATION

Potential participants will be recruited through the outpatient clinics at a single academic medical center. The site may review existing records for patients to determine potential participants. Participants may also be recruited by their clinical audiologists, who will refer the potential participant to the clinical research team to verify candidacy. Study-related procedures will occur after informed consent or parental permission and assent (if required) forms have been explained and signed. Participants who are suitable candidates for the study should complete the enrollment/baseline procedures in *Section 7.2.2*.

7.2.2 VISIT 1: ENROLLMENT/BASELINE

- Informed consent
- Parent/Legal Guardian permission (if applicable)
- Assent (if applicable and required by IRB)
- The participant's existing fitting map will be converted for use with SONNET 3 (EAS), keeping all fitting parameters identical to their current fitting MAP

- Participant instructed on use of SONNET 3 (EAS) AP for take-home trial
- Visit 1 case report form (CRF) is completed

7.2.3 VISIT 2: 3-WEEK INTERVAL

- Audio Processor Comparison Survey is completed by subject
- Visit 2 CRF is completed

7.2.4 ENROLLMENT CONCLUSION

- Audiologist Survey is completed

7.2.5 SCHEDULE OF EVENTS TABLE

	Enrollment	Visit 1	Visit 2	Enrollment Conclusion
Informed Consent	X			
Audio Processor Comparison Survey			X	
Study Exit			X	
Audiologist Survey				X

7.3 PRECAUTIONARY PROCEDURES

Not applicable

7.4 PROHIBITED PROCEDURES

Participants should have a stable map before enrolling. The goal is to compare the same fitting map in each process to isolate only characteristics that are new to SONNET 3 (EAS). Unilateral and bilateral study participants will receive one SONNET 3 (EAS) Audio Processor for the take-home trial period and should avoid reprogramming the existing audio processor on either ear between study visits.

8 ASSESSMENT OF SAFETY

8.1 DEFINITIONS AND CLASSIFICATIONS

8.1.1 DEFINITION OF ADVERSE EVENTS (AE)

An adverse event is any unfavorable change in the health of a participant that happens during a clinical study or immediately after the study has ended. This change may or may not be caused by the intervention studied (*Glossary of Common Site Terms - ClinicalTrials.gov*).

8.1.2 DEFINITION OF ADVERSE DEVICE EFFECTS (ADE)

Adverse events will be reported as related to the study device if the event is known to occur with audio processor use or programming in the MAESTRO System Software, or if there is a reasonable possibility that the audio processor or programming software caused the event. Reasonable possibility means that there is evidence to suggest a causal relationship between the study device and the event. Events occurring immediately after programming the device or use of the audio processor during the trial may also suggest a device-related adverse event.

8.1.3 DEFINITION OF SERIOUS ADVERSE EVENTS (SAE)

Adverse events are considered serious when they result in death or any injury or illness that is life-threatening, results in permanent impairment or damage to the body, or requires medical or surgical intervention to prevent permanent harm to the body.

8.1.4 DEFINITION OF UNANTICIPATED ADVERSE DEVICE EFFECTS (UADE)

Unanticipated adverse device effects are defined as any event not previously known to occur with audio processor or software use. Risks associated with the device are detailed in Section 2.3.1 above. Events can be unexpected in nature, severity, or degree of incidence. This definition could include an unanticipated adverse device effect or other serious adverse effect associated with the device, if the problem was not previously identified in nature, severity, or degree of incidence.

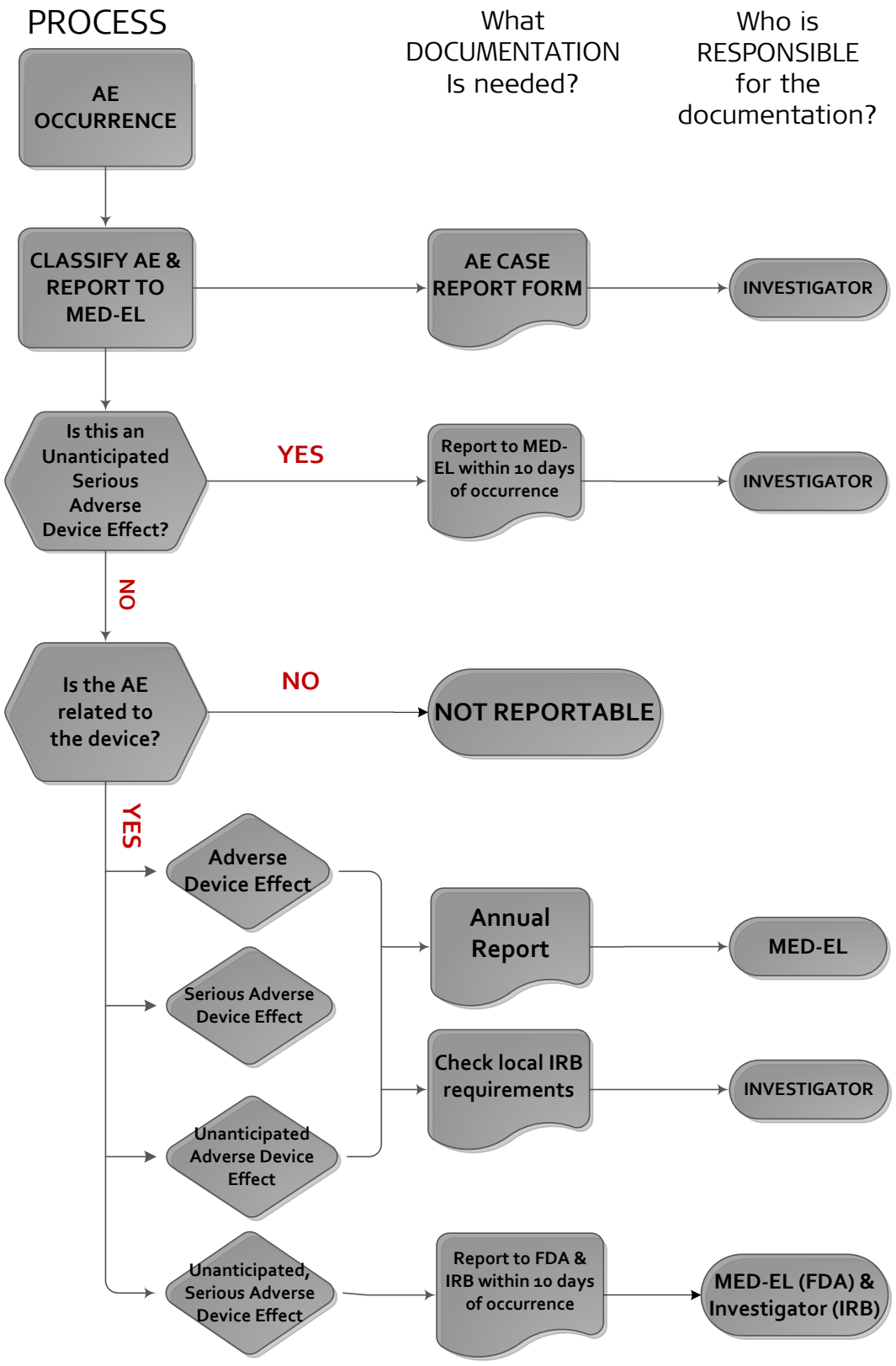
8.2 TIME PERIOD AND FREQUENCY FOR EVENT ASSESSMENT AND FOLLOW-UP

The occurrence of an adverse event may be brought to the attention of investigators during study visits, interim visits, or phone calls during the study. All adverse device effects will be recorded on the Adverse Event Report Form (CRF), including event description, date of onset, time of onset, relationship to the device, seriousness, unexpectedness, and the date/time of resolution (if applicable). Adverse events will continue to be followed until reaching adequate resolution or stabilization. Additional information for an ongoing adverse event will be reported as part of the same event and will not constitute a new event.

8.3 REPORTING PROCEDURES

8.3.1 ADVERSE EVENT REPORTING

Any adverse device effect discovered during the study should be recorded on the Adverse Event CRF by an investigator and reported to MED-EL. Investigators are responsible for determining if the adverse event meets the definitions for device -related, serious, and/or unanticipated. Questions regarding classification should be directed to the MED-EL Clinical Monitor. All ADEs should be reported to the MED-EL Clinical Monitor in a timely manner. All adverse device effects will be reported to the FDA and to relevant IRBs in the annual report. Investigators should reference the flow chart below (Figure 1) and Section 8.3.2 to determine appropriate reporting procedures, depending on AE type.


PROCESS
What DOCUMENTATION Is needed?
Who is RESPONSIBLE for the documentation?
AE OCCURRENCE
CLASSIFY AE & REPORT TO MED-EL
AE CASE REPORT FORM
INVESTIGATOR
Is this an Unanticipated Serious Adverse Device Effect?
YES
Report to MED-EL within 10 days of occurrence
INVESTIGATOR
NO
Is the AE related to the device?
NO
NOT REPORTABLE
YES
Adverse Device Effect
Serious Adverse Device Effect
Unanticipated Adverse Device Effect
Unanticipated, Serious Adverse Device Effect
Annual Report
MED-EL
Check local IRB requirements
INVESTIGATOR
Report to FDA & IRB within 10 days of occurrence
MED-EL (FDA) & Investigator (IRB)

(FIGURE 2)

8.3.2 UNANTICIPATED SERIOUS ADVERSE DEVICE EFFECT REPORTING

If the investigator determines that the adverse event is unanticipated, serious, and device - related, the CRF should be submitted to the MED-EL Study Monitor no later than 10 working days after becoming aware of the event. Additionally, the investigator should notify the reviewing IRB of the unanticipated serious adverse device effect within 10 working days.

Upon receiving this documentation, MED-EL will review and submit the information to FDA within 10 working days. Additional reports concerning the effect will be submitted upon FDA request.

8.4 STUDY HALTING RULES

MED-EL will review all serious, unanticipated adverse device effects to determine if the study should continue per the protocol, be modified, or be discontinued. Examples of findings that would trigger a safety review are the number of serious adverse events occurring overall, the number of occurrences of a particular type of serious adverse event, or increased frequency of events (e.g., device deficiencies). If findings indicate that the study or protocol should be reconsidered, MED-EL will inform FDA of the disposition of the study.

A stopping rule of three unanticipated serious adverse device effects would prompt suspension of enrollment and/or study intervention use. Based on the definitions of an Adverse Device Effect, Serious Adverse Event, and Unanticipated Adverse Event provided in Sections 8.1.2, 8.1.3, and 8.1.4, respectively, a Serious unanticipated Serious Adverse Device Effect:

1. Results in death, injury, or illness that is life-threatening; results in permanent impairment or damage to the body; or requires medical or surgical intervention to prevent death, life-threatening injury/illness, or permanent harm to the body,
2. Is unanticipated in nature, severity, or frequency from the known potential risks,
3. Is related or possibly related to participation in the research,
4. Suggests that the research places participants or others at a greater risk of harm than was previously known or recognized, and
5. There is a reasonable possibility that the device caused the event

9 CLINICAL MONITORING

Clinical monitoring is conducted to ensure that the rights and well-being of subjects are protected, that study data are accurate, complete, and verifiable, and that the study is being conducted in compliance with the approved protocol/amendment(s), with GCP, and with applicable regulatory requirements. MED-EL Corporation personnel and/or a qualified Contract Research Organization (CRO) will be responsible for monitoring this investigation according to MED-EL Corporation's SOPs.

Clinical monitors will conduct on-site pre-study site visits at each prospective site. During this visit, the monitor will evaluate the facilities and staff and review study-specific details and obligations with investigators. Investigators will demonstrate understanding of the following information at the conclusion of the pre-study site visit:

- Obligation to conduct the study in accordance with the investigator agreement, GCP, and other applicable regulations
- Device accountability and traceability requirements for investigational devices
- Requirements for a well-controlled study
- Investigator's role in the process of obtaining parental permission
- Obligation to obtain and maintain IRB approval
- Importance of complete and accurate study records, including source documentation
- Required monitoring and clinical monitor access to the study records
- Time commitments for investigators involved in the study
- Details specific to the investigational plan

Once the study and enrollment have begun, periodic monitoring will occur. The type and frequency of these visits will depend on the number of subjects enrolled, the completion or accuracy of study records received by MED-EL, and the occurrence of adverse events and protocol deviations. These periodic site visits will evaluate whether:

- The facilities continue to be acceptable for the study
- The protocol is being followed
- Changes to the protocol have been reported to and approved by the IRB
- Verification of source documentation and source data
- Reports to the Sponsor and IRB are accurate, complete, and on time

After completion of any monitoring visit, the clinical monitor will document the observations, conclusions, and corrective actions taken to address any findings. The documentation will include the visit date, name of the monitor, name of the investigator and site, and address of the site. Case report forms and other related study documentation will be reviewed as MED-EL receives the completed paperwork throughout the study. Completed study records will be reviewed 100% for missing data entries. Accuracy of study records will be monitored based on the investigator's history, accuracy of study records, the rate of adverse events, and the occurrence of protocol deviations.

10 STATISTICAL CONSIDERATIONS

10.1 STATISTICAL HYPOTHESES

Primary Endpoint:

At least 77% of participants will report improvement (mean score >3 on a 6-point Likert scale) in processor design with the SONNET 3 (EAS) compared to the existing audio processor on the Design subsection of the Audio Processor Comparison Survey (APCS) at Visit 2.

Secondary Endpoints:

1. Summary of patient-reported satisfaction rating (6-point Likert scale) on subsections of the Audio Processor Comparison Survey (APCS) with SONNET 3 (EAS) at Visit 2.
2. Summary of audiologist-reported satisfaction ratings on subsections of the Audiologist Survey at enrollment conclusion.

10.2 SAMPLE SIZE

The sample size estimate is based on attaining adequate power to test the primary hypothesis that at least 77% of participants will report subjective improvement in audio processor design with SONNET 3 (EAS) over the existing processor based on a single survey. The hypothesis test is a one-sample, one-sided test of the proportion of participants reporting an average score of >3 on the Audio Processor Comparison Survey (APCS) compared to 77%, based on the clinical trial for the Cochlear Nucleus 7 audio processor, where an average of 77% of participants responded with greater than neutral agreement (>50 on a 100-point scale) on survey questions addressing satisfaction with improved comfort with the new audio processor. For the purpose of this sample size calculation, 77% will represent the desired participant response proportion.

A power analysis was conducted using a binomial two-proportion test with the package ‘pwr’ in R. Using a 95% confidence interval, a sample size of 20 participants would provide 85% probability of rejecting the null hypothesis ($H_{0<}$ 77%). Calculations are based on the following assumptions:

- Hypothesized proportion: H_0: $p<0.77$;
- Expected proportion: H_1: $p\geq0.77$
- Significance level = 0.05
- One-sided
- Effect size h=0.36

10.3 ANALYSIS DATASETS

The intent-to-treat (ITT) population is defined as all enrolled participants including withdrawn participants who have been replaced. The modified ITT (mITT) population is defined as all participants who completed Visit 1 and Visit 2. The per protocol (PP) population is defined as participants who:

- Completed Visit 1 and Visit 2
- Were using the SONNET 3 (EAS) device consistently throughout the trial period
- Are free from major protocol deviations, including but not limited to:
    - Non-use of the SONNET 3 (EAS) during the trial
    - Missing test measures from one or more intervals
    - Evidence of not meeting inclusion/exclusion criteria after completion of study intervals

Analysis for the primary endpoint will be completed on the mITT and the PP populations.

10.4 DESCRIPTION OF STATISTICAL METHODS

10.4.1 GENERAL APPROACH

Continuous variables will be summarized using mean, median, inter-quartile range, minimum, and maximum values. Categorical variables will be summarized using counts and percents. Testing of the primary endpoint will be done at the 0.05 level of significance.

10.4.2 ANALYSIS OF THE PRIMARY EFFECTIVENESS ENDPOINT

The proportion of participants reporting design superiority with SONNET 3 (EAS) on the APCS will be calculated for the primary endpoint The participant's responses to the Design subsection questions will be averaged and the proportion of participants who rated >3 on average will be compared to the hypothesized proportion of 77%. The statistical hypothesis for the primary endpoint is defined as:

H_0: $p<0.77$
H_1: $p\geq0.77$

where p is the proportion of participants who responded with a mean score of >3.

10.4.3 ANALYSIS OF THE SECONDARY ENDPOINT(S)

All endpoints will be summarized using descriptive statistics outlined in Section 10.4.1. Descriptive statistics will be compared across intervals and audio processor type.

10.4.4 SAFETY ANALYSES

Not applicable

10.4.5 ADHERENCE AND RETENTION ANALYSES

Not applicable

10.4.6 BASELINE DESCRIPTIVE STATISTICS

Baseline demographics will be summarized using mean, median, inter-quartile range, minimum, and maximum values. Categorical variables will be summarized using counts and percents.

10.4.7 PLANNED INTERIM ANALYSES

No interim analysis will be conducted for this study.

10.4.8 ADDITIONAL SUB-GROUP ANALYSES

If sample size permits, results of the secondary endpoints will be stratified by age and existing audio processor model.

10.4.9 MULTIPLE COMPARISON/MULTIPLICITY

Not applicable

10.4.10 TABULATION OF INDIVIDUAL RESPONSE DATA

Individual responses on the Audio Processor Comparison Survey and the Audiologist Survey will be summarized separate from group analysis.

10.4.11 EXPLORATORY ANALYSES

Not applicable

10.5 MEASURES TO MINIMIZE BIAS

This study utilizes a paired design where participants act as their own control. This reduces bias by accounting for within participant variability.

10.6 SITE POOLABILITY

Not applicable

11 SOURCE DOCUMENTS AND ACCESS TO SOURCE DATA/DOCUMENTS

Source documentation should be kept as part of the participant's medical records. Source documentation (e.g., medical history, audiologic history) should be accessible to the clinical

study monitors, as needed, for comparison to CRFs. Additionally, FDA may audit any investigational site and would require access to source documentation at that time. Medical records kept on each participant will include information about the participant's participation in the clinical trial.

12 QUALITY ASSURANCE AND QUALITY CONTROL

MED-EL will implement all necessary procedures to ensure the integrity of CRFs. As part of the periodic monitoring visits, the clinical monitor will compare all study records to the source documents and ADD-source data to verify accuracy. When CRFs are received, the forms will be reviewed for completeness and to identify any inconsistencies or errors. Investigators will be trained to make corrections only by approved methods. Any discrepancies found in the CRFs by the Clinical Monitor should be brought to the attention of the investigator.

For the data management process, data may be entered into a database using accepted data entry techniques. Database validation will be performed after the last study interval has been completed. A more comprehensive evaluation of the database will be performed as required i.e., data analysis.

13 ETHICS/PROTECTION OF HUMAN PARTICIPANTS

13.1 ETHICAL STANDARD

The investigator will ensure that the study is conducted in accordance with regulations for the protection of human participants found in 21 CRF Part 50, 21 CRF Part 56.

13.2 INSTITUTIONAL REVIEW BOARD

The protocol, informed consent (IC) form, parental/guardian permission form, assent form, and any recruitment or participant materials will be submitted to the IRB for review and approval. IRB approval of both the protocol and consent forms must be obtained prior to beginning enrollment. Any amendment to the study protocol must also receive IRB approval before those changes are implemented in the study. Changes to any of the consent forms will also be submitted to the IRB; at that time, a determination will be made as to whether or not participants or parents/guardians who previously provided consent need to be re-consented.

13.3 INFORMED CONSENT PROCESS

13.3.1 CONSENT DOCUMENTS PROVIDED TO PARTICIPANTS

A consent, parental /legal guardian permission, or assent form with detailed descriptions of the study device, study procedures, and risks will be given to the participant. Written documentation of IC, parental permission, and assent (if required by the IRB) is required prior to

initiating any study-related activities. The IC, parental permission, and assent templates included with this protocol will be provided to the site.

13.3.2 CONSENT PROCEDURES AND DOCUMENTATION

Informed consent, assent (when required), or parental permission will be obtained before the candidate participates in any study-related activities. Potential participants must be informed as to the purpose of the study and the potential risks and benefits known, or that can be reasonably predicted or expected. These risks are described in the written consent form.

Consent, parent permission, and assent forms will be IRB approved and the participant or parent/guardian will be asked to read and review the document. The investigator will explain the research study to the participant or guardian and will answer any questions that may arise. All participants or guardians will receive a verbal explanation of the purpose, procedures, and potential risks of the study, as well as their rights as research participants.

The participant or guardian will sign the IC, assent, or parental permission form prior to being enrolled in the study. The investigator administering the IC will sign and date the form to indicate the document was sufficiently explained to the participant or guardian and their signature was witnessed. Consent may be withdrawn at any time during participation in the study. A copy of the signed IC will be provided to the participant or guardian, while the original will be retained by the investigator in the study file.

13.4 PARTICIPANT AND DATA CONFIDENTIALITY

The study protocol, documentation, data, and all other information generated will be kept in strict confidence. No information concerning the study, or the data will be released to any unauthorized third party, without prior written approval of MED-EL. The investigator will guarantee that all persons involved will respect the confidentiality of any information concerning the clinical trial participants.

All parties involved in a clinical investigation will maintain strict confidentiality to assure the protection of privacy of a participant participating in the clinical investigation. Likewise, appropriate measures will be taken to avoid the access of non-authorized persons to the clinical trial data.

All information provided to the investigator by MED-EL will be kept strictly confidential and confined to the personnel involved in conducting the trial. Such personnel will be informed of the confidential nature of the information. It is recognized that this information may be communicated in confidence to the relevant IRB. In addition, no reports or information about the trial or its progress will be provided to anyone not involved in the trial, other than MED-EL or the relevant IRB, except if required by applicable law or regulation.

All data provided to MED-EL will be identified by a unique participant ID, thereby ensuring that the participant's identity remains unknown. The participants should be informed in writing that their data will be stored and analyzed in a computer, with confidentiality maintained in accordance with applicable regulations.

The participants should also be informed that authorized representatives of MED-EL and/or regulatory authorities may require access to parts of the site records (relevant to the study), including medical history, for data verification. The investigator is responsible for keeping a subject identification list of all subjects screened and enrolled.

14 DATA HANDLING AND RECORD KEEPING

14.1 DATA COLLECTION AND MANAGEMENT RESPONSIBILITIES

Prior to initiation of the study, investigators who may complete CRFs and are responsible for maintaining appropriate documentation will be identified. The investigator will be responsible for maintaining complete and accurate documentation of study procedures and medical records, including IC forms, for the duration of the study. Correspondence with the IRB, Clinical Monitor, and MED-EL in general should also be maintained. Data on participants will be collected in an anonymous manner, and any records sent to MED-EL should be de-identified.

The investigator is responsible for ensuring completeness, legibility, and accuracy of the recorded data. Source documentation should be completed in a neat, legible manner to ensure accurate interpretation of the data. When making changes or corrections, cross out the original entry with a single line, and initial and date the change. Do not erase, write over, or use correction fluid or tape on the original document.

Copies of the electronic CRF will be provided for use as source documents, as needed, and maintained for recording data for each participant enrolled in the study. Data reported in the electronic CRF derived from source documents should be consistent with the source document. Any discrepancies should be explained and captured in a note and maintained in the participant's official study record.

14.2 STUDY RECORDS RETENTION

Upon completion of the study, it is the investigator's responsibility to maintain all study records in a safe and secure location. Study-related documents should be kept for the duration of the study, as required by 21 CFR Part 812.40 and the institution's IRB. No study documents will be destroyed during this period. Investigators will contact MED-EL if study documents must be moved to a different storage location during this period.

14.3 PROTOCOL DEVIATIONS

Any noncompliance with the protocol or with GCP requirements will be reported to MED-EL in the protocol deviation log as a protocol deviation. Protocol deviations may be on the part of the investigator, participant, or other study staff. Corrective actions will be implemented based on the type and frequency of protocol deviations from each site. Investigators are responsible for being familiar with the protocol and regulations and to be vigilant regarding potential protocol deviations. Deviations should be submitted to MED-EL and the IRB in a timely manner, as required.

14.4 PUBLICATION AND DATA SHARING POLICY

All results generated in this study will be considered strictly confidential. The site investigator may not submit the results for publication without prior written permission of MED-EL.

At the written request of MED-EL, investigators may submit the results for presentation at conferences.

15 CONFLICT OF INTEREST POLICY

Any actual conflict of interest of persons who have a role in the design, conduct, analysis, publication, or other aspect of this trial will be disclosed and managed.

16 LITERATURE REFERENCES

1. Lorens A, Malgorzata Z, Skarzynski H. A new audio processor for combined electric and acoustic stimulation for the treatment of partial deafness. Acta Oto-Laryngol. 2012;132: 739-750.
2. Martin J, Poncet-Wallet C, Illg A, Perrin-Webb S, Henderson L, Noël-Petroff N, Auletta G, Grazia Barezzani M, Houri K, Indian Research Group, Bagus H, Hoppe U, Humphries J, van Treeck W, Briaire JJ, Brendel M, Mathias N. Multicentre evaluation of the Naída CI Q70 sound processor: feedback from cochlear implant users and professionals. Audiol Res. 2016;6(2), 160.
3. Warren CD, Nel E, Boyd PJ. Controlled comparative clinical trial of hearing benefit outcomes for users of the Cochlear™ Nucleus® 7 Sound Processor with mobile connectivity. Cochlear Implants Int. 2019;20(3), 116-126.

Version	Date	Significant Revisions
1.0	02 August 2024	Original version
2.0	19 August 2024	Revised sample size calculation and statistical test for primary endpoint