

Music Rehabilitation for Adult Cochlear Implant Recipients



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Introduction

The aim of the Music Rehabilitation for Adult Cochlear Implant Recipients is to provide support and guidance for hearing professionals who work with adult cochlear implant (CI) recipients who are interested in music. This brochure provides an overview of aspects to consider in music rehabilitation and includes ideas and suggestions for music activities that can be used in therapy sessions or independently practiced at home.

There are two aspects when it comes to music: music perception and music appreciation. Music perception involves analytical, psychoacoustic tasks that focus on perceptual accuracy. Whereas music appreciation focuses on the enjoyment of music through a complex process of subjective estimation of the perceived quality.

As part of holistic hearing healthcare, it is important to consider the impact music has on quality of life. Music continues to matter to many CI recipients, even if the sound quality may initially be disappointing. Adults tend to listen to music following cochlear implantation, and it is considered a highly important acoustical stimulus. However, it is second in importance after speech perception (Frederigue-Lopes et al., 2015; Drennan & Rubinstein, 2008).

Following cochlear implantation, active participation in music rehabilitation may improve music perception and appreciation and thus, consequently quality of life. Long-term musical experience can change the representations of sounds in the auditory system, resulting in improvements to the acuity of sound and speech. Through music training, recipients have demonstrated improvements in musical perception, enjoyment, and participation in music activities (Calvino et al., 2015; Looi & She, 2010; Lassaletta et al., 2008).



There is evidence that listening to music and music training helps CI recipients perform better in understanding speech in noise (Smith, 2017; Slater et al., 2015). This is due to the recipients' focused attention while listening to complex signals such as focusing on a specific instrument in a complex music extract. Through focused attentional listening, non-musical outcomes include improved ability to understand speech in noise, localization, and emotional inference (Parbery-Clark et al., 2011; Parbery-Clark et al., 2009; Musacchia et al., 2007; Wong et al., 2007; Kraus & Nicol, 2005).

Music can have a positive impact for those who may be experiencing cognitive functioning challenges. Extended music experience can improve some aspects of cognitive linguistic functioning such as auditory attention, phonological processing, and speech perception in background noise. It may also help adults with executive functioning particularly in episodic memory, short term memory, inhibiting (being able to completely focus on one area and not be drawn in by distraction), and planning (Shahin, 2011; Kraus & Chandrasekaran, 2010; Musacchia et al., 2008; Musacchia et al., 2007; Wong et al., 2007). Research suggests that music has many benefits for CI recipients such as improvements in speech understanding and quality of life.

"I am so thankful for the hearing my CIs provide every day. One of the greatest gifts of this new hearing is the return of music to my life. Waking up with a song in my head is such a wonderful way to start the day. Listening to music that gives me goosebumps makes me so thankful to once again enjoy the powerful emotions of music."

MED-EL CI Recipient

Frequently Asked Questions from Cochlear Implant Recipients

1. Why should music be part of my rehabilitation?

Music training can improve music perception and have an impact on music enjoyment. The benefits may also transfer to other domains such as cognition, understanding speech in noise, localization, emotional inference, executive functioning, and improved perception of sound and speech.

2. What advice would you give to people who want music to be part of their lives?

Be patient! Initially, it takes practice and time to improve music perception and appreciation.

3. When can I start listening to music?

Priorities may vary. You may want to initially focus listening to speech. However, you can listen to music early on in your listening journey. Start when you are ready. Keep in mind that perception will change especially in the first year. Keep an open mind and explore music. Don't give up.

4. What is the best approach to successfully retrain music?

An active approach is the best approach. It is important to listen to music actively in which you are specifically focusing on the music. You should listen to music regularly and long term.

5. What kind of music should I begin with?

It is better to start with familiar music. Start with songs that have one or only a few instruments that are playing a simple tune. It is more challenging to listen to many instruments (e.g., orchestra) or to a few instruments playing a complex tune.

6. Are some musical elements easier to hear than others?

For most, rhythm is the easiest. Pitch and timbre are more challenging.

7. What will my music perception be like?

This depends on various factors (e.g., duration of deafness, electrode insertion, music training, etc.). There is high variability across CI recipients. Usually, rhythm and timing information is typically well preserved. Pitch is one of the more difficult musical elements to perceive. This will vary for each individual. It takes practice over time to achieve best possible pitch perception.

Musical Elements refers to the parts of music and includes pitch and melody, timbre and texture, dynamics, meter and duration, tempo, rhythm, harmony, tonality, and structure.

8. If I have residual hearing in the other ear, how do I practice with my CI ear?

Initially, it is important to spend time practicing with the CI ear only. Use direct connect for ear training exercises or music listening exercises. Make sure to also spend time listening to music with both ears.

9. Will I be able to play my musical instrument again?

Yes. Make sure you take time to practice, explore, and experiment with your instrument to achieve best possible perception and appreciation of music.

10. What advice would you give to musicians?

Ear training to improve pitch should be particularly emphasized along with the other music activities.



Starting Music Rehabilitation

Music is the most complex and sophisticated form of sound. Recipients may find it difficult to enjoy music when they first receive their CI. Every individual's journey to perceive and appreciate music will be different. Below are some tips that can be helpful to CI recipients along the way.

Expectations

- Evidence and research show that for CI recipients, initially in terms of sound quality of music, it can often be disappointing. It is important for recipients to know that active participation can improve the perception of music. Consequently, a limited ability to listen to music can lead to less effort to relearn it (Bartel et al., 2011; Migirov et al., 2009). Stress that improvement takes time.
- Expectation counseling prior to cochlear implantation plays an important role in satisfaction with listening to music. Emphasize that CI recipients vary in music enjoyment. There are many factors that may have an impact on the outcomes (e.g., duration of deafness, neural survival, motivation). Discuss with the individuals their unique hearing loss profile.
- To ensure realistic expectations for music training and music enjoyment, hearing professionals should take time to understand the motivations, backgrounds, and aspirations of CI recipients. Hearing professionals can then provide focused training and possible strategies that might be utilized toward more realistic levels of improvement.
- Sometimes, CI recipients may not be aware of the progress they have already made. It is important to track and point out successes which can in turn further motivate them to keep practicing.
- Stress to recipients that music perception and appreciation takes training, exposure, and experience, just as it does with speech.

When to Start

- It is best to engage in music training as part of rehabilitation as early as possible.
- Some CI recipients will want to get started right after activation and some will want to wait. When to start music training will vary from person to person. CI recipients should be given time to adjust to their CI; however, they should not have to wait a significant amount of time to start music training.

Focused Music Listening

Focused music listening refers to actively listening to music and attending to it rather than having music playing in the background and not attending to it. Below are suggestions for choosing music when engaging in focused music listening.

Simple vs. Complex Music

- Start with simple songs (e.g., known cultural songs, Happy Birthday song).
- Pick songs that contain a small number of words.
- Choose songs that have highly repetitive words and melody line.
- Develop a library of simple songs that CI recipients tend to rate as easy to listen to.

Familiar vs. Unfamiliar Songs

- For many CI recipients, one of the most important factors in enjoying music is familiarity of music. Ask the recipients what songs they listened to previously. Develop a library of songs that are familiar to them. There may be songs that are an important part of different cultures and countries (e.g., national anthem). Folk songs and songs related to occasions and events are another important source of familiar songs.
- Familiarity depends on several factors. These include the associated musical heritage, musical training, preferences, and experience. Someone who has had several years of formal training is likely to have learned a subset of tunes with which others are not familiar. When it comes to song selection, initially start with well-known songs. Have the recipients make a list of these songs. Gradually choose a mixture of well-known and unfamiliar music so that CI recipients do not guess the music, but really focus on listening to and analyzing the music. It is important to start with songs that give the recipients the best possible chance of success, and then move on to less familiar songs over time.



Well Known Songs

Under Familiar Songs, list those that the CI recipient was very familiar with prior to their hearing loss. To monitor progress, note Yes under Recognition next to the song when the CI recipient can recognize the song easily.

Style	Familiar Songs	Recognition
Classical		
Hip Hop		
Rock 'N' Roll		
Country		
Bollywood		
Rap		
Musicals		
Pop		
Opera		
Jazz		
Blues		
Reggae		
Other		

Solo vs. Group Arrangement

- It is easier to start with music that has a single instrument playing a simple song. Listening to an orchestra playing a complex piece of music can be very challenging for new CI recipients.
- Start with songs that have one singer or music that has one instrument. You can introduce songs with several singers or instruments gradually as the training progresses.

Instruments

- Consider using instruments in therapy sessions. Introduce different instruments to the recipients. Talk about, describe, and have the recipients play and explore the instruments. This can also be done by using visuals such as pictures of the musical instruments. Discuss musical elements, how the same piece of music can be played in different ways, etc.
- Extend using instruments into listening exercises such as identifying an instrument, identifying tempo played (fast vs. slow), identifying ascending vs. descending scale being played, etc. This can help recipients start to understand how music sounds through their CI.



Visual Support

- Listening can be reinforced through visual support when songs are initially introduced. These supports can include sheet with music notes, lyric sheet, visuals of the music tracks being played, and using pointers to track the melody.

Live vs. Recorded

- One of the greatest advantages of live music is that the performance can be seen as well as heard.
- Live music can provide a positive social experience because it can be enjoyed with others in a social setting which may add to quality of life.
- Live music provides access to the natural flow of the instruments. The music is heard as it was meant to be.
- When listening to recorded music, the device used (e.g., ear buds, headphones, laptop) will have different frequency ranges which can make music sound different compared to it being performed in a live environment.

Listening Environment

- When listening to music, as with speech, it is best for CI recipients to be in a good listening environment.
- Gfeller et al. (2001) suggest that music practice sessions should begin in an optimal listening environment. That is a room that has little background noise or echo. Try to minimize outside noise from people or traffic. Turn off the appliances (e.g., air conditioning, heating) that might interfere with music training. To decrease reverberation, use soft surfaces (e.g., carpets, tapestries, cushions) to dampen the noise.
- In natural environments, listening to music should be through both ears (e.g., hearing aids, cochlear implant, normal hearing). In therapy sessions or in specific focused music listening, it should be done through the CI alone. For CI recipients who either have normal hearing in the other ear (single-sided deafness) or use a hearing aid in the contralateral ear (bimodal), it is important to directly connect their audio processor with the sound source to practice. Contact your local MED-EL representative for more information on direct audio input.

Music Ear Training

Music ear training refers to an approach where exercises are practiced for the purpose of improving an individual's ability to discriminate and identify elements of music such as pitch, intervals, melody, chords, scales, and rhythm through hearing alone. Music ear training may help improve perception of relevant musical elements which in turn helps in the perception of the complex signals in music. So, music training in other words is music perception and discrimination training.

Research has shown that enhanced musical abilities may improve speech perception in noisy surroundings, which relies on pitch cues to separate the target from the background (Parbery-Clark et al., 2009; Qin & Oxenham, 2003) and the ability to identify voice gender and speaker, which largely depends on discrimination of timbral cues (Vongphoe & Zeng, 2005). Additionally, brain-imaging studies have shown that complex music tasks activate brain areas associated with language processing (Vuust et al., 2011; Levitin & Menon, 2003). Therefore, specific music ear training can have benefits beyond music perception.

Active Music Engagement

Active music engagement through performance or creating music is effective in music training. Former musicians or singers are encouraged to get back to their instruments or singing. It is important for CI recipients to know that active participation can help in the adjustment to the changing sound. Many CI recipients enjoy the sound of their instruments after practicing with them for a while which supports the theory that training improves perception and enjoyment of music.

Creating music involves several sensory systems (e.g., auditory, visual, tactile) and makes demands on a variety of cognitive processes. These multimodal interactions can lead to stronger changes in auditory processing than training in the auditory alone modality (Herholz & Zatorre, 2012).

Practice, Practice, Practice

Music initially can sound different and then change over time when using a CI. For example, CI recipients may have difficulty distinguishing between two different notes played on a keyboard but eventually will be able to discriminate between them. It takes time and practice to improve music perception and appreciation.

Some CI recipients have said that by simply listening to music regularly their appreciation for music has improved. A suggestion for simple practice would be to have CI recipients listen to songs they knew well before their hearing loss and have them initially attend to the rhythm of the music rather than the lyrics. Their brain may be able to provide missing information based on its memory of what the rhythm was before the hearing loss. Eventually, the quality of sound will get better, and lyrics become more understandable. The key to improving listening skills is persistence, practice, and time. Music should be considered as a separate part of the CI journey.

"The more I listened, the better the music sounded. My brain just needed time to figure out how to listen to music with my CIs."

MED-EL CI Recipient

Music Activities

Music activities can be practiced by having the hearing professional present live music (e.g., playing a drum) or by using recorded music or an app. The following are examples of music activities that can be carried out in your clinical practice. The activities are divided into five categories. Most of the exercises can be used in an individual therapy session, in a group setting, or in remote situations.

1 Rhythm

The goal of rhythm training is to strengthen the perception of basic features of rhythm such as meter, beat, tempo and patterns.

1a) Move to the Beat

The hearing professional plays a drum at either a fast or slow tempo. The CI recipients move (e.g., clap, nod, stomp) to the speed of the beat played on the drum. When CI recipients become more comfortable with this activity, the hearing professional can shorten and vary the tempi (speed) to make the activity more challenging.

1b) Recognize the Tempo

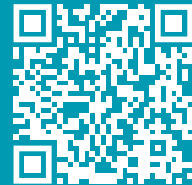
CI recipients recognize different tempi by playing simple rhythmic patterns using percussion instruments. The hearing professional introduces a slow rhythmic pattern on a percussion instrument and then asks the recipients to join in to practice the tempo. Next, the hearing professional plays a fast rhythmic pattern, and the recipients imitate it. The hearing professional then chooses either the slow or fast rhythmic pattern as the target pattern and tells the recipients which tempo they need to listen for and imitate. The hearing professional alternates playing between slow and fast rhythmic patterns randomly, and the recipients only imitate when they recognize the targeted tempo.

1c) Play Along to Music

CI recipients recognize different tempi by playing along to music with a percussion instrument. The hearing professional selects music recordings that differ in tempo and starts by introducing two recordings that are truly opposite to each other (e.g., fast vs. slow). When the CI recipients can differentiate two opposite tempi, the hearing professional can introduce more music recordings with varying degrees in tempo.

Apps are also great way to help CI recipients to work on specific parameters. There are many apps available that focus on specific musical elements. Additionally, Meludia is an online music training program for hearing implant users. It provides comprehensive, independent, and long-term music training regardless of indication, musical background, or duration of hearing implant use. It aims to support hearing implant users in their goal to improve music enjoyment, music perception, and other listening skills.

Check out
Meludia here!



1d) Recognize the Rhythmic Patterns

In this activity, CI recipients determine if two rhythmic patterns are the same or different. The hearing professional uses a drum and introduces an example of a same rhythmic pair and an example of a different rhythmic pair. It is also possible to use pre-recorded rhythmic patterns to create same and different pairs. Then the hearing professional plays two rhythmic patterns, either same or different, and the recipients determine which one it is.

1e) Follow the Conductor

The hearing professional acts as the role of conductor, and the CI recipients play a percussion instrument according to instructions given by the conductor. The hearing professional starts as the conductor giving instructions such as start, stop, fast, slow, loud, soft, group, or solo. The CI recipients follow the commands with their instruments. The instructions can be given verbally or visually. CI recipients can also be given an opportunity to become the conductor.

2 Pitch

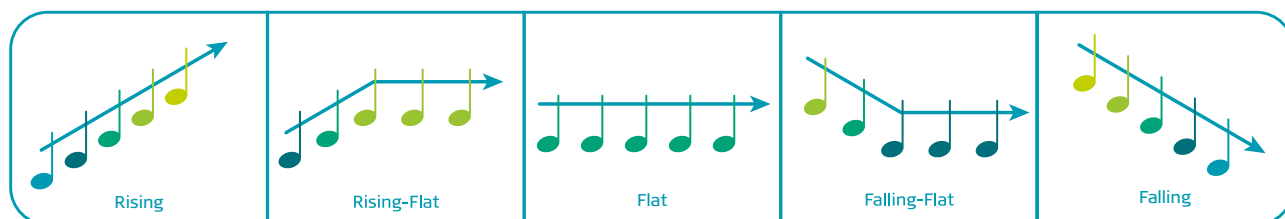
The goal of pitch training is to develop basic musical attributes such as high and low, up and down, far and close, and melodic direction.

2a) Recognize Difference in Pitch

The hearing professional introduces different pitched (high and low) tones on a melodic instrument and describes the pitch to the recipients as high or low. After several times, the hearing professional then plays random high- and low-pitched tones on the instrument and the recipients identify if it is high or low. Gradually, the activity may be developed by decreasing and/or increasing the distance between the pitches.

2b) Recognize Contours

The hearing professional starts by introducing two contours, ascending and descending, on a melodic instrument and describes the contours to the recipients. Initially, introduce the contours using at least five notes to provide more musical context. Once familiarized, the hearing professional plays the two contours randomly and recipients determine the contour played. Eventually more contours can be introduced as shown in the pictures below to increase the options to select from. To make this task more challenging, the contours can be adapted by decreasing the number of notes and/or decreasing the interval step size between the notes.



3 Instruments

The goal is to introduce percussion and melodic instruments. This gives recipients an opportunity to listen to and hear the different sounds, such as quality and timbre, each instrument makes.

3a) Introduction of Percussion Instruments

CI recipients get to know percussion instruments and use them to practice recognition and discrimination of timbre. The hearing professional introduces various percussion instruments, one at a time. Start with instruments that have larger timbre or sound differences (e.g., drum vs. maraca) and name, describe each instrument, and provide opportunity for recipients to spend time playing them. It does not matter how the instruments are played.

A percussion instrument is a musical instrument that is sounded by being struck or scraped (e.g., bongo, maraca, cymbals).

3b) Recognize Percussion Instruments

Once CI recipients have become familiar with the percussion instruments, the hearing professional plays two percussion instruments for them to listen to. Next, the hearing professional, out of sight of the recipients, plays one of the instruments. The recipients identify which one it is. It is easier to start by using a different rhythmic pattern for each instrument. To increase the difficulty, increase the number of percussion instruments to differentiate from, select percussion instruments from the same family group (e.g., hand drum vs. bongo), and use the same rhythmic pattern for each percussion instrument.



3c) Imitate Patterns

The hearing professional provides a percussion instrument to the recipients, introduces a simple rhythmic pattern, and the CI recipients imitate the pattern. Next, the hearing professional introduces another rhythmic pattern and recipients imitate. This process can be repeated, and the rhythmic pattern can become more complex.

Melodic instrument refers to an instrument which provides a range of tones (e.g., guitar, piano, xylophone, chime).

3d) Introduction of Melodic Instruments

CI recipients get to know melodic instruments and use them to practice recognition and discrimination of timbre and pitch. The hearing professional introduces various melodic instruments, one at a time. Start with instruments that have larger sound differences (e.g., flute vs. piano) and name, describe each instrument, and provide opportunity for recipients to spend time playing them. It does not matter how the instruments are played.

3e) Recognize Melodic Instruments

Once CI recipients have become familiar with the melodic instruments, the hearing professional plays two melodic instruments for them to listen to. Next, the hearing professional, out of sight of the recipients, plays one of the instruments. The recipients identify which one it is. It is easier to start by using a different melodic pattern for each instrument. To increase the difficulty, increase the number of melodic instruments to differentiate from, select melodic instruments from the same family group (e.g., guitar vs. violin), and use the same melodic pattern for each melodic instrument.

4 Emotional Inference

The goal of emotional inference training is to develop recognition of emotion in music.

Words to describe the emotions of music:

happy	uplifting
sad	relaxing
lonely	fun
heartbroken	emotional
harsh	romantic
healing	depressing

4a) Recognize Emotion

Start by talking about different emotions that music can make people feel. Next, recipients are given four picture cards that represent four emotions (e.g., happy, sad, angry, and afraid). The hearing professional plays four short clips of music that represents these emotions one by one. The recipients are expected to match the music to the picture cards based on emotions. Initially, start with large-contrast music (e.g., happy vs. sad). Then increase the complexity by decreasing the contrast (e.g., sad vs. heartbroken) and increasing the number of emotions. Perception of emotions in music is a subjective experience. Give recipients the chance to discuss the music clips that were played to express how and why they chose a specific emotion to represent the music.

Music Instrument Identification

Hearing professional plays a recording of one of the instruments, and the CI recipient identifies which instrument.

Guitar



Trumpet



Flute



Violin



Piano



Drums



5 Music Identification

The goal is to identify a specific feature in music.

5a) Identify Instrument in Complex Situation

CI recipients concentrate on the main musical instrument ignoring the accompaniment. The hearing professional initially presents one main music instrument playing a rhythm. Gradually, an additional musical instrument is added. The recipients are expected to point out when the additional instrument starts and pay attention to the main instrument played ignoring the background instrument. The recipients should discuss with their hearing professional how well they are able to discriminate the main instrument from the other one. In the beginning keep the rhythm of both instruments different, and slowly this activity can be made more complex by matching the rhythm of the two instruments.

5b) Tune Identification

CI recipients demonstrate recognition of a tune. Prepare a library of songs that are well known to the recipients. Start with songs that have large melody differences. The hearing professional sings, plays recorded music, or plays the melody on an instrument, and the recipients identify the song. Gradually, introduce unfamiliar tunes along with the familiar ones to increase the complexity. The recipients determine if they can recognize a song or determine if it is an unfamiliar song.

5c) Tune and Lyric Memory

The hearing professional introduces songs that contain lyrics one at a time. Once the CI recipients are familiar with the song, the hearing professional sings it or plays a recording of it and then stops the song at random places. The recipients fill in the next words of the song. Eventually, to increase the complexity of the task, background sounds may be added as distractions during the song presentation.



Music Focus Groups

Although most aural rehabilitation programs for adults with CIs are provided on a one-to-one basis, there has been some recognition of the value of group activities. The music focus group concentrates on CI recipients sharing their experiences of their music journey. Additionally, it can provide the opportunity to practice structured music activities that enhance music perception and appreciation. Hearing professionals or the CI recipients themselves can form a music focus group. This can be a positive experience where recipients benefit from having the opportunity to interact with others who have hearing loss and diverse musical experiences. It allows recipients to share their knowledge and experiences and learn from each other.

Things to Consider During Formation of a Music Focus Group

- **Venue**
The music focus group can be formed virtually or live. During live sessions, the room needs to be relatively quiet with no reverberation. The room should also be well lit.
- **Equipment**
Equipment needs will vary depending upon the different media being used. Recordings can be played using a mobile phone, tablet, etc. The output should be connected to a quality speaker.
- **Materials**
The choice of the materials is done by the individual who is running the session. Familiar and unfamiliar playlists, music instruments, apps, games, and other materials can be used in the session. Be conscious to choose materials that are suitable for CI recipients.
- **Participants**
The size of the group depends on the goal of the program and the platform (e.g., online vs. live). If activities are planned, it is suggested to limit the number of participants to a maximum of 10.
- **The Role of the Hearing Professional**
It is important to remember that music focus groups are designed to provide the CI recipients with opportunities to practice music activities in a controlled, supportive environment. The hearing professional provides a range of musical experiences, encourages comments, listens to the CI recipients' opinions, and leads discussion.

Remote Music Rehabilitation

Hearing professionals are connected to CI recipients via internet for music rehabilitation that includes assessment, intervention, and consultation.

Things to Consider During Remote Rehabilitation Sessions

- Technology such as smartphone, tablet, laptop. It is essential that the technology used provides the CI recipients with access to good sound quality.
- A webcam or microphone which can be built-in or separately attached.
- High-speed internet connection.
- Access to a shared videoconferencing platform such as Zoom, Teams, Skype, WeChat, Facetime, Messenger, Adobe Connect, etc.
- Test and try out the technology.
- The hearing professional should use a headset or earphones with an attached microphone for better audio performance during the music focus group session.
- Length of the session should be slightly shorter compared to a live session as it can be more challenging and tiring to listen online.
- Number of participants depends on the expectations and objectives of the group session. If the objective is more interactive and focused on listening, there should be up to six people in the group which allows for more conversation during the session. If the objective is more of a listening only kind of activity, then you could have a larger group, expecting limited interaction. The size of the group will depend upon whether the aim is for a small focus group or a large listening activity group.
- The most important tip for conducting the group activities is to run the groups in pairs. It is best to have two individuals running the session. This allows for one person to focus and be engaged in listening and talking with recipients about music. The other person can manage the technical aspects and chat box.
- Avoid constant PowerPoint presentation. Use slides and pictures with captions minimally and encourage listening.
- Content should be person-centered; consider personal music memories.
- Keep the music activities short and very focused to keep recipients listening and engaged.
- Use a multisensory approach to support the CI recipients. Use a combined visual, auditory, kinesthetic, and tactile approach. Have the recipients see things (e.g., pictures, color-coded instructions), hear things (e.g., listen to music, opportunities to speak and listen to others), move around (e.g., move to music), manipulate things (e.g., drag and drop activities).

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Notes

MED-EL Offices Worldwide

AMERICAS

Argentina

medel@medel.com.ar

Canada

officcanada@medel.com

Colombia

office-colombia@medel.com

Mexico

office-mexico@medel.com

United States

implants@medelus.com

ASIA PACIFIC

Australia

office@medel.com.au

China

office@medel.net.cn

Hong Kong

office@hk.medel.com

India

implants@medel.in

Indonesia

office@id.medel.com

Japan

office-japan@medel.com

Malaysia

office@my.medel.com

Philippines

office@ph.medel.com

Singapore

office@sg.medel.com

South Korea

office@kr.medel.com

Thailand

office@th.medel.com

Vietnam

office@vn.medel.com

EMEA

Austria

office@at.medel.com

Belgium

office@be.medel.com

Finland

office@fi.medel.com

France

office@fr.medel.com

Germany

office@medel.de

Italy

ufficio.italia@medel.com

Portugal

office@pt.medel.com

Spain

office@es.medel.com

South Africa

customerserviceZA@medel.com

United Arab Emirates

office@ae.medel.com

United Kingdom

customerservices@medel.co.uk

MED-EL Medical Electronics
Fürstenweg 77a | 6020 Innsbruck, Austria | office@medel.com

medel.com

