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Teleaudiology: the contribution of remote access in cases of cochlear implant – a systematic review

Teleaudiologia: a contribuição do acesso remoto nos casos de implante coclear – uma revisão sistemática

Teleaudiología: la contribución del acceso remoto en casos de implante coclear: una revisión sistemática

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Abstract

Introduction: Teleconsultation may be beneficial in several aspects: social, economic, therapeutic and normative. The use of teleconsultation in audiology has been extensively studied in some services, especially in the remote programming of Cochlear Implant users. **Objective**: To investigate the applicability, strengths and weaknesses of teleconsultation in audiology for Cochlear Implant users. **Method**: This is a systematic review that carried out searches in the databases with no limitation on the year. The study selected and included only non-randomized intervention studies, descriptive studies and case study. The procedures for the applicability of teleconsultation, the description of strengthens by the patients, professional, or between professional and patient, and the descriptions of weaknesses were evaluated for reading in full. **Results**: Fourteen studies in English and Brazilian Portuguese were included. Remote follow-up studies were found as follows: mapping, speech tests (measurements of T and C levels), techniques and configuration of remote platforms and speech-language pathology guidance. **Conclusion**: There are many ways that make CI successful in teleconsultation, such as mapping, guidance and therapy. Users reported strengthens and satisfaction, such as cost savings, among others. In turn, facilitators reported the contribution to their professional performance as a rehabilitator, and specialists felt safe

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Authors' contributions:
RPBD: study design, methodology, data collection and study outline.
MASCB: study design, data collection, critical review and guidance.

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when carrying out the mapping procedures. Reported weaknesses were as follows: delayed connection, delayed stimulus and, consequently, delayed sessions, long reverberation time of the auditory stimulus.

Keywords: Remote consultation; Cochlear implant; Telemedicine

Resumo

Introdução: A teleconsulta pode ser benéfica em diversos aspectos: social, econômico, terapêutico e normativo. Na audiologia, a realização da teleconsulta vem sendo bastante estudada em alguns serviços, principalmente, na programação remota de usuários de Implante Coclear. **Objetivo**: Investigar a aplicabilidade, vantagens e desvantagens da teleconsulta em audiologia para os usuários de Implante Coclear. **Método**: Trata-se de pesquisa de revisão sistemática em que foram realizadas buscas nas bases de dados sem limitação de ano. Foram selecionados e incluídos, somente estudos de intervenção não randomizados, estudos descritivos e estudo de caso. Para leitura na íntegra, foram avaliados os procedimentos de aplicabilidade da teleconsulta, descrição dos pontos positivos pelos pacientes, profissional ou entre profissional e paciente, além da descrição de suas desvantagens. **Resultados**: Foram incluídos quatorze estudos, da língua inglesa e português do Brasil. Foram encontrados estudos de seguimento remoto nos seguintes casos: mapeamento, testes de fala (mensurações de níveis T e C), técnicas e configuração de plataformas remotas e orientações fonoaudiólogicas. **Conclusão**: Há diversas maneiras que possibilitam o sucesso do Implante Coclear na teleconsulta como mapeamento, orientações e terapia. Os usuários referiram benefícios e satisfação como redução de custos entre outros. Os facilitadores referiram contribuição em sua atuação profissional como reabilitador, e especialistas sentiram-se seguros ao realizarem os procedimentos de mapeamento. As desvantagens foram: atraso na conexão, atraso do estímulo e, consequentemente, atraso nas sessões, longo tempo de reverberação do estímulo auditivo.

Palavras-chave: Consulta remota; Implante coclear; Telemedicina

Resumen

Introducción: La teleconsulta puede ser beneficiosa en varios aspectos: social, económico, terapéutico y normativo. En audiología, la teleconsulta se ha estudiado ampliamente en algunos servicios, principalmente en la programación remota de usuarios de implantes cocleares. **Objetivo:** Investigar la aplicabilidad, ventajas y desventajas de la teleconsulta en audiología para usuarios de implantes cocleares. Método: Ésta es una encuesta de revisión sistemática en la que se realizaron búsquedas en las bases de datos sin limitación de año. Solo se seleccionaron e incluyeron estudios de intervención no aleatorios, estudios descriptivos y estudios de casos. Para la lectura completa, se evaluaron los procedimientos de aplicabilidad de la teleconsulta, descripción de los puntos positivos por parte de los pacientes, profesional o entre profesional y paciente, además de la descripción de sus desventajas. **Resultados:** Se incluyeron 14 estudios de inglés y portugués brasileño. Se encontraron estudios de seguimiento a distancia en los siguientes casos: mapeo, pruebas de habla (mediciones de niveles T y C), técnicas y configuración de plataformas remotas y guía de habla y lenguaje. **Conclusión:** Hay varias formas de hacer que el Implante Coclear tenga éxito en la teleconsulta, como mapeo, orientación y terapia. Los facilitadores informaron su contribución a su desempeño profesional como rehabilitador y los especialistas se sintieron seguros al realizar los procedimientos de mapeo. Las desventajas fueron: conexión retardada, estímulo retardado y, en consecuencia, sesiones retardadas, tiempo de reverberación prolongado del estímulo auditivo.

Palabras clave: Consulta remota; Implantación coclear; Telemedicina

Introduction

Technology is part of people's reality and everyday life and its use is inevitably increasingly more common and frequent also in professional practices. Technological resources enable actions to be developed even if people are physically and temporally distant, creating a new form of contact, which differs from traditional standards and regulations[1]. This practice reduces inequalities in access to health services, especially for geographically isolated populations and reduces costs with the moves of patients to places that provide specialized care or from the professional to the patient[2].

Telehealth is the use of the Internet and technologies to promote files and information that may assist in the health care response and includes activities such as teleconsultation. Teleconsultation, as well as teleconsulting, allows healthcare professionals to communicate quickly and directly with patients and/or other professionals, regardless of the distance[3].

Teleconsultation has been widely disseminated and used in audiology, both in the screening of simplified auditory processing, and as a tool to assist in the diagnosis, treatment, and counseling, in addition to the remote programming of electronic devices, such as the Personal Sound Amplification Product (PSAP) and the Cochlear Implant (CI)[4].

In turn, teleaudiology has been consolidated in the United States and is trying to reach even remote locations in the world, in which access to health is restricted[5]. In Brazil, there has been an increase in the applicability of telehealth in the last decade, including an increase in subsidies for research and treatments. Government initiatives, such as the "National Telehealth Program in Brazil", which is initially focused on supporting primary care, have expanded to cover all levels of care[6].

As for the Speech-Language Pathology, the Resolution no. 366 of 2009 of the Brazilian Federal Council of Speech-Language Pathology and Audiology (CFFa)[7] defines Telehealth as a legal activity in Speech-Language Pathology, with the use of information technology (IT) - activities and solutions based on computing and telecommunications resources - among others in order to provide assistance, promote education and conduct research in health.

In 2013, CFFa issued the Resolution no 427 defining the division of speech-language pathology activities in telehealth, such as consultation, involving the speech-language pathologist and the patient with another speech-language pathologist, at a distance, with both diagnostic and therapeutic support actions[4].

Programming via synchronous teleconsultation is technically feasible in cases of CI, in which at least two subjects are online, and the clinical results are comparable to those obtained in face-to-face care[2]. Given that most studies in the field are primarily focused on the technical feasibility of the clinical procedures performed, further studies are needed to assess the perception of patients regarding the CI programming in this context[2].

Devices such as the CI are used to improve the hearing performance and, therefore, oral communication. However, the success of the treatment requires factors such as the family and the appropriate use of the CI, in order to ensure the development of the patient's communicative potential, especially children[8].

Post-surgical follow-up is mandatory, including the analysis of the speech perception performance, defining a routine of follow-up visits of the CI user to the Hearing Health Centers. Initially, these follow-up visits should take place monthly and then annually[2]. Thus, teleconsultation can be a facilitating factor to promote the attendance of CI patients in all stages of treatment, including their family members.

In view of the vast territory of Brazil, telehealth can be seen as an alternative to promote the access of patients to health services, avoiding long transports of CI users and their caregivers, reducing direct and indirect costs, such as transportation, food and accommodation[2]. This would even reduce costs for the Brazilian Unified Health System (SUS) in its budget for the Treatment Outside the Home (TFD)[9].

Given that teleconsultation can be effective in several aspects, such as social, economic and therapeutic aspects, and as Brazil is one of the pioneer countries, together with the United States, Australia and South Africa, in conducting research in the field of telehealth in audiology, this study aims to investigate the applicability, strengths and weaknesses of teleconsultation in audiology for Cochlear Implant users.

Methods

This is a systematic review study that consisted primarily of searches in the following databases: *Cochrane Library*, *International Prospective Register of Systematic Reviews* (PROSPERO) e Virtual Health Library (VHL), in order to expand knowledge related to the topic. Regarding the subject and the formulated approach, no reviews in progress were found at the time of the study.

The main question of this study was: "What is the applicability, strengths and weaknesses of teleconsultation in audiology for Cochlear Implant users?".

The items of the recommended PICOS process (Participants = users and/or applicants for cochlear implant; Intervention = teleconsultation in the different cases of cochlear implant; Comparison = results of the face-to-face and remote routes; Outcomes = contribution of the distance care, describing its applicability and weaknesses in a qualitative way; Study design = non-randomized intervention, descriptive studies and case study) were applied using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology[11].

The following electronic databases were used to search for studies: Cochrane, Web of Science, Scopus, PubMed/MEDLINE, SciELO, Virtual Health Library (VHL) – (LiLACS, ADOLEC, and IBECS) and Google Scholar. The study also analyzed dissertations and theses in the databases of higher education institutions that offer graduate courses in Speech-Language Pathology (assessment area - Physical Education), synchronized through the Sucupira platform.

The following descriptors were used: *Cochlear Implants OR hearing aids AND remote consultation OR telemedicine OR telehealth*, also in Portuguese: *implante coclear OR prótese auditiva OR prótese coclear AND teleconsulta OR telessaúde OR telemedicina OR consulta remota*, combining both forms by means of two Boolean operators and their synonyms indexed on the platforms: Health Sciences Descriptors (DeCS) and Medical Subject Heading (MeSH).

Selection criteria

At first, the analysis selected studies in each database that included at least two of the descriptors in the title. Then, the abstracts of these studies were read. When the selected studies were duplicated, they were introduced in EndNote, a bibliographic management software, listing the studies probably included for further analysis from the abstract, again, for better reliability for reading in full.

The following inclusion criteria were also defined in the selection of studies: studies published in English, Portuguese and Spanish; with no limitation on the year of publication and ending the search in March 2020. The procedures for the applicability of teleconsultation, strengths and weaknesses described, both by patients and professionals, were evaluated for reading in full. Next, the pre-included studies were evaluated, including analysis and collection of information about the CI user population (newborn, child, adolescent, adult and elderly), the duration of each session or the treatment performed through teleconsultation , study objective, author, year and country.

Data analysis

In view of the objective of this study and the reduced number of publications on the applicability of teleaudiology/teleconsultation for CI users, the researchers decided to analyze, include and classify the studies through the adjusted multiple Cox model[12], in order to mitigate possible losses.

The Cox[12] scale proposes 6 levels of evidence, in which the first levels are those that indicate greater evidence. Level 1 of evidence is the most convincing, including systematic reviews and meta-analyzes of randomized studies; level 2 includes randomized clinical trials; level 3 includes non-randomized intervention studies; level 4 includes descriptive studies (cross-sectional, cohort study, case control); level 5 includes case study (the latter 3 with a lower degree of evidence); and, finally, level 6 includes less convincing evidence (expert opinion without patient-centered data support).

A blind analysis of the studies was carried out based on independent evaluations conducted by two (2) Speech-Language Pathologists, who work with Cochlear Implants, who verified the aspects related to the study objective and the methodology used. The information was entered into a Microsoft Excel spreadsheet in an outlined plan and, in cases of doubt and/or disagreement, online meetings were held to try to reach a consensus.

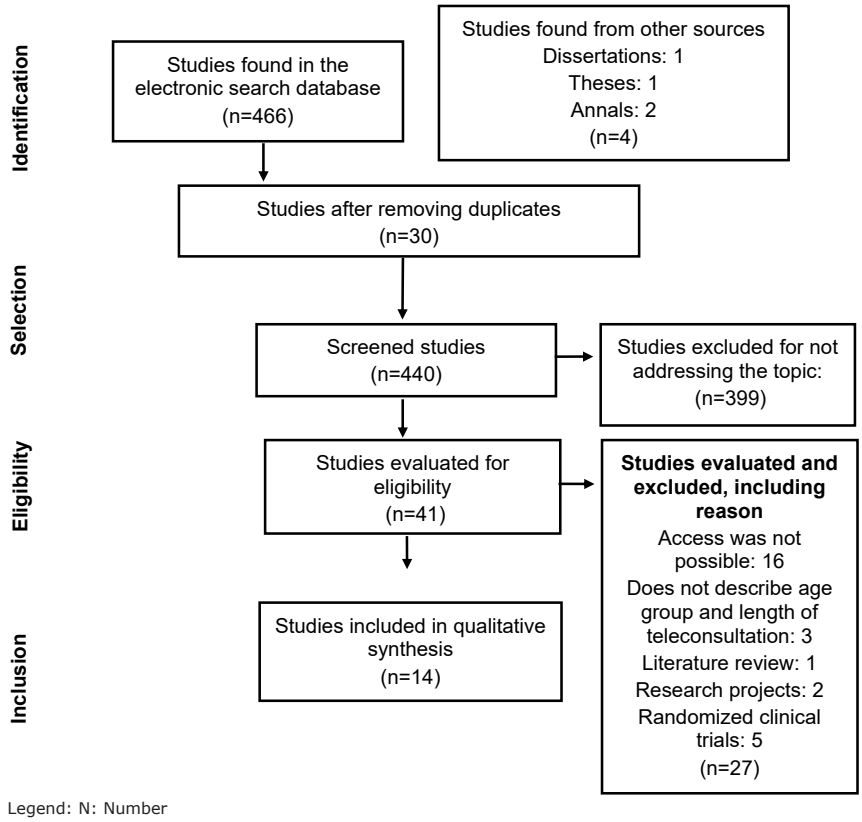
Results

At first, 466 studies were identified in the electronic databases, in addition to 4 dissertations, theses and annals, totaling 470 studies. After removing duplicate studies through the bibliographic manager software, 440 studies remained for analysis.

Then, 399 studies were removed after reading the abstracts, as they did not address the topic, leaving 41 studies to be read in full. Among these, 16 studies were removed due to the impossibility of digital access, 3 for not describing the age group of the subjects and the length of the session/treatment by teleconsultation, a literature review, 2 research projects and 5 for being studies randomized clinical trials.

Thus resulting in the selection of 14 studies.

It should be noted that the PRISMA[11] methodology (as shown in Figure 1) was followed throughout the process of identification, selection, evaluation and analysis of the selected studies.



Legend: N: Number

Figure 1. Synthesis of the process of identification, selection, evaluation and analysis of the selected studies

Chart 1 shows the author, year, country, level of evidence of the studies, purpose, age group, and length of session/treatment of the teleconsultation.

Among the 14 studies analyzed, 11 were published in English and 3 in Brazilian Portuguese. The studies were from Brazil (n=3), the United States (n=7), the Netherlands (n=2), Russia (n=1) and Spain (n=1).

Regarding the purposes, 6 studies were focused on the programming of CI processors, checking and comparing the modality (face-to-face and remote), 6 studies addressed assessments through speech tests to measure minimum (T) and maximum levels of comfort (C), one study was focused on techniques and configuration for favorable procedures for teleconsultation and one study addressed orientations to family members.

Chart 1. Characteristics of included studies

Author/Year/ Country	EL	Purpose	Age group	Length of teleconsultation
Slager et al. 2019 (United States)	3	To investigate the safety and effectiveness of remote CI programming	12 to 88 years	12 months
Vieira, 2019 (Brazil)	3	To investigate the impact of virtual speech-language pathology guidance to family members of CI users in the immediate postoperative period.	1 to 10 years	8 20-minute sessions, once a week, for 2 months.
Graaff et al. 2018 (The Netherlands)	4	To compare the results of speech recognition tests in silence and noise assessed at home with the results of tests in the clinic on CI users	44 to 83 years	3 sessions in two weeks (1st and 3rd sessions at the clinic and 2 session at home)
Hughes et al. 2018 (United States)	4	To describe the configuration of equipment and techniques to successfully assess behavioral thresholds of young children using CI using telepractice	1.1 to 7.1 years	Average of 12.4 and 16.4 minutes
Hughes et al. 2018 (United States)	4	To test the feasibility of telepractice to measure behavioral thresholds in young children using CI	1.1 to 3.4 years	Average face-to-face and remote session of 12.4 and 13.0 minutes
Goehring and Hughes, 2017 (United States)	4	To determine if the T levels measured via telepractice were different between sessions (remote and face-to-face)	2.6 to 7.1 years	Average remote and face-to-face session of 16.4 and 15.4 minutes
Graaf et al. 2016 (The Netherlands)	3	To develop a remote tool for speech recognition tests in CI users, as well as its application and reliability.	Individuals with normal hearing (22 to 41 years) CI users (44 to 83 years)	Less than an hour and 30 minutes
Kuzovkov et al. 2014 (Russia)	4	To evaluate the use of remote programming in different countries to determine its ease of use and operation, with CI users (MED-EL)	5.8 to 81.9 years	33 sessions with an average of 51.5 minutes for face-to-face sessions and 48.1 minutes for remote sessions
Samuel et al, 2014 (Brazil)	4	To investigate the effectiveness of remote programming in CI users, both in audiological results and in programming parameters in remote and face-to-face conditions.	18 to 59 years	1 day, all participants
Goehring et al. 2012 (United States)	4	To evaluate the effect of speech perception via telehealth, and acoustic environment in CI users.	12 to 87 years	1 day, approximately 2 hours.
Hughes et al. 2012 (United States)	4	To compare CI measurements, comparing telehealth with conventional methods.	11 to 87 years	3 sessions in two weeks, with the 1st and 3rd sessions in the clinic (131 minutes) and the 2nd at home (138 minutes)
McElveen et al. 2010 (United States)	4	To evaluate the effectiveness of remote programming in CI users (Nucleus Freedom)	15 to 87 years	12 months
Ramos et al. 2009 (Spain)	4	To assess the technical feasibility, risks and difficulties of remote programming in CI users, in addition to the benefits, comparing with the standard programming path.	25 to 55 years	4 days: 2 remote sessions with an average of 21 minutes. 2 face-to-face sessions with an average of 20 minutes.
Zumpano et al, 2009 (Brazil)	5	To investigate the necessary resources to make the remote programming of the CI System viable and to investigate the benefits and limitations for the implementation of this model of assistance in hearing health care in Brazil.	12 and 14 years	2 consecutive days, one patient each day (one hour and 40 minutes and one hour and 15 minutes).

Legend: EL: evidence level; CI: cochlear implant

Discussion

The technology assists professionals, patients and their families in the process of adapting to the CI. Accordingly, digital platforms help these subjects to reduce physical distances, allowing the connection between them through video conferencing, for example.

Remote care is a resource that may assist in the application of speech recognition and/or perception tests, even enabling the measurement of these results. It can also assist in the programming of the CI, using the specific applications of each brand of IC for that purpose.

The technology allowed the development of techniques and configurations that made it possible to adapt speech tests originally designed for listeners and apply them to CI users[13].

Teleconsultations can be hybrid, by means of synchronous communication, when professionals and patients are connected in real time through audio and video equipment, and asynchronous, using previously recorded material[14,15]. Thus, it enables professionals to care for patients and focus on questions on the CI and its components, issues involving the family, the school and the speech-language pathology therapy[1].

Specifications such as connection and software must be assessed with respect to the possibility of applying speech perception tests, so that the CI specialist audiologist and the facilitator have satisfactory results. In other words, the entire structure must be standardized before the start of the monitoring. The programming cable in remote programming must be specific to the processor and/or brand of the device, for backups to be made. In these cases, the audiologist has exclusive control over all programming that is password protected, such as using the Custom Sound Suite software[16].

Conditioned audiometry and visual reinforcement audiometry (VRA) can also be performed in addition to speech perception tests. Visual reinforcements are obtained by means of toys operated by the test assistant by means of remote control or footswitch, resulting in good results and indicating possible use of these conventional pediatric methods in teleconsultation[17].

A clear, continuous and explicit approach in the communication between the test assistant and the CI specialist is necessary for the responses to the tests to be adequate, with the test assistant at a game table with a webcam. The entire programming process is carried out using programming software and a cable connected to the device, synchronously. In this sense, the assistant should check the video conference system before programming, so that any doubts are clarified.[17].

In addition, the programming cables must be connected to the cochlear implant processors, with the support of the test assistant, in order to obtain T levels (audibility threshold) through VRA and conditioned audiometry, with the electrodes positioned in the basal, middle and apical regions, allowing a more reliable response. In this situation, the camera must be positioned behind the child, in order to remove distractions, and the remote visual tool used by the assistant, such as the VRA, must be positioned next to the device implanted on the game interaction table. It should be noted that all of these procedures performed remotely were attended by the assistant in the first face-to-face programming[18,19].

Regarding the minimum levels of electrical current and/or stimulation, the T levels correspond to the audibility threshold with the CI, while the maximum levels of stimulation, which are called C levels, are the highest acceptable levels to avoid discomfort[20].

Speech tests created and adapted can also be used, such as digits-in-noise test[21], via a tablet, reproduced via an external sound card, such as the Creative Sound Blaster X-FI HD SB1240 and HDA200 Sennheiser headphones. The signal-to-noise ratio for individuals with normal hearing is -4dB and 0dB for testing purposes, while for CI users, both applied in an acoustic environment, at 65dB, with responses typed for standardization purposes. For this purpose, it should be noted that the authors tested the software in 3 forms of application ("practice, test and test again") and the data obtained comparing the face-to-face and remote conditions[13] did not show statistical differences, suggesting its use.

European experts (from Russia, Italy and Sweden) investigated the effectiveness of remote programming and described that the face-to-face session interface performed by the facilitator was shared with the remote specialist, who performed the entire device mapping process. Thus, in addition to enabling programming, the device connected to the software performed video and audio transmission, allowing synchronous com-

munication between facilitator and specialist and validating the respective programming. Experts who also worked as facilitators reported that the length 97% of telemetry sessions were similar to that of a face-to-face session[22].

A study carried out in Brazil, which investigated the minimum (T levels) and maximum comfort (C levels) levels of five electrodes, using speech perception tests and free field audiometry connected to the speech processor programming software, found a significant difference when comparing the applicability of these (face-to-face and remote) on three electrodes in the search for minimum stimulation levels (T levels), with the highest current in remote programming. And an electrode in the search for maximum stimulation levels (C levels), with the lowest current in remote programming. However, no significant differences were found in the two types of care for the results of speech perception and audiometry tests[23].

No significant differences were found in speech perception tests, such as the Hearing in Noise Test (HINT) and the monosyllabic word test applied in different cities in the United States, using different processors and with equivalent scores for both types of care (face-to-face and remote)[24].

Similarly, no difference was found between the care conditions in silence and noise when comparing statistical data from speech recognition tests in silence and noise in face-to-face and remote environment. In addition, although better scores were obtained via teleconsultation when investigating speech results in noise, there was no statistical difference[25].

As previously reported, teleconsultation makes it possible to provide guidance to family members regarding the device, the participation of family, school and the speech-language pathology therapy. A different topic can be approached in a hybrid way each week. Family members are informed about the topic 24 hours before the appointment and the first five minutes of the teleconsultation are usually used to clarify doubts on the video sent and/or any event during the week. Then, the orientation of the week is addressed in 10 minutes and the final five minutes are open to family members so that new doubts can be answered. The "device" (programming, parts warranty terms, charging battery, use of disposable batteries, safety in handling the device) and "school" (importance of the school in the process of adapting the device and the knowledge of education professionals on the use and handling of the device and its importance) axes had significant differences between care conditions (face-to-face and remote), in addition to positive impacts via teleconsultation[1].

Device programming has already been conducted in Brazil using the Custom Sound software of Cochlear Corporation over 1500 km away with good results. Participants reported benefits, such as time savings and reduced expenses related to commuting, accommodation and the possibility of not being absent from school or work, even if the remote programming session lasts one hour and fifteen minutes[26].

Although most studies describe strengths[1,13,16-18-19,22-29] over the applicability of teleaudiology in relation to the follow-up of the implanted patient, one study[27] reported weaknesses when evaluating the effect of speech perception via telehealth and found an increase in noise of 28dB NPS in the speech perception tests in silence and noise. This raises the possibility that there was a reverberation of sounds, impairing the performance of the participants, when compared to an acoustically treated environment.

High levels of background noise and longer sound reverberation times were also reported by other authors, but with no statistical difference between care conditions (face-to-face and remote)[28].

As the strength of the magnet must be evaluated in person, the initial programming makes the first remote consultation unfeasible, in addition to initial electrical stimulations, so that they are stored, thus making possible the teleconsultation after the first programming[29].

In Brazil, the presence of a speech-language pathologist with or without experience in programming, as a facilitator, is necessary for the application of auditory perception tests, remotely, for mapping the device. In European countries and the United States, the application of these tests can be performed by the test assistant, so training is required in this approach.

As for facilitators, most describe good outcomes[16,22,26] and report that such experiences contributed to their professional performance as a rehabilitator. Despite the difficulties related to specific mapping procedures, the difficulties were overcome, including safety during the programming sessions. Only one study[19] reported the substitution of 3 expert facilitators by a test assistant

to assist in conditioned audiometry with toys, referring to inaccurate answers from specialists.

Regarding user experiences, most[16,25,28] reported good results: ease and feasibility when connecting and starting the application to run the tests, even if they are not proficient with the use of a computer and/or tablet, for example. Parents reported that 82% would use teleconsultation for CI programming, if available[17], while 100% of caregivers would use it[19]. In another study, 99% would recommend it to other users, while 96.9% were satisfied with the results[22], in addition to safety, ease and economy, contributing to the CI programming[29].

Only four (4) of the fourteen (14) selected studies did not describe the average consultation length between face-to-face and remote sessions. Among the studies that described this aspect, there was little variability when comparing the length used in the two modalities. Only one study described shorter remote consultation length when compared to face-to-face sessions[20]. In turn, the length was longer in the remote approach compared to the face-to-face session in a case study, but the users and the facilitator still reported benefits[26].

There is little information on the availability of software for mapping the CI for commercialization via telehealth in Brazil. In general, the software was applied in the studies only for research purposes and for particular cases. Health plans did not reimburse the consultation via telehealth until the time of data collection for this review.

However, there were changes in March/April 2020 regarding the coverage of Telehealth in Brazil, including procedures in Speech-Language Pathology. Such changes and adaptations occur due to the pandemic due to the new Coronavirus Sars-CoV-2 (COVID-19), in which elective face-to-face visits were suspended to avoid contagion between subjects.

Thus, the Brazilian Society of Speech-Language Pathology and Audiology (SBFa) made the HiTalk platform available, bringing patients and users closer and enabling telehealth care. Therefore, ensuring confidentiality and privacy between the parties and providing the same efficiency, effectiveness and equivalence of face-to-face care[4].

Currently, telehealth is becoming an opportunity for growth and expansion at the national and international level, both scientific and clinical, through the use of video conferencing applications, such as Zoom for Healthcare®, Skype for Business®, Google G Suite Hangouts Meet ® and GoToMeeting® among others, and according to the encryption security measures recommended by the HIPAA[30] protocol. These applications have been frequently used in several areas in order to overcome the difficulties imposed by the current moment. These tools can also be used to monitor CI users, favoring both guidance on the use of the device and therapies, as well as other approaches in the field of Speech-Language Pathology and related sciences.

Conclusion

It was possible to conclude that teleconsultation is effective in audiology for cochlear implant users and can be applied both face-to-face and remote sessions, provided that the particularities of this type of care are met. It is possible to program the device, apply speech perception tests and provide guidance to family members.

As for the strengths, users and professionals reported cost reduction, easy testing, practicality, strengthening of conducts, among other positive points. The facilitators report improvements in their professional performance as rehabilitators, and specialists felt safe when carrying out the mapping procedures.

As for the weaknesses, users and professionals reported: difficulties in connection, delay in stimulus conduction, delay in sessions, background noise and long reverberation time in auditory perception tests, in addition to the need for the first mapping to be performed in person.

Finally, it should be noted that teleconsultation is a care modality that can be perfectly applied in cases of cochlear implant, both by providing guidance to patients and family members and in speech-language pathology guidance.

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