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The reality of the speech therapy and yhe prosody in deaf children benefiting from cochlear implants in Algeria

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ABSTRACT

This study aims to investigate speech-language pathology (SLP) intervention with regard to prosody in deaf children who have received cochlear implants in Algeria. To achieve this goal, the descriptive method was adopted as a framework for data analysis and interpretation. The study sample consisted of 30 speech-language pathologists working in public health institutions and private practices distributed across various regions of the country. Data was collected through a questionnaire specifically designed for this study, which included five main axes: (1) General Information, (2) Prosody Rehabilitation Approach, (3) Evaluation and Intervention in Prosody, (4) Training and Knowledge, and (5) Challenges and Recommendations. The results of both quantitative and qualitative analyses revealed that speech-language pathologists pay attention to early intervention for deaf children with cochlear implants. However, prosody does not receive sufficient attention within the adopted therapeutic programs. The study's findings highlight the need to strengthen the training of professionals in this area and to develop intervention tools that take into account the prosodic features of the language.

Keywords: speech-language intervention, prosody, deaf children, cochlear implant.

في الجزائر واقع التكفل الأرطوفوني بالبروزوديا لدى الأطفال الصم الحاملين للزرع القوقعي

ملخص:
تهدف هذه الدراسة إلى تسليط الضوء على واقع التكفّل الأرطوفوني بالبروزوديا لدى الأطفال الصمّ المستفيدين من الزرع القوقعي في الجزائر. ولتحقيق هذا الهدف، تم اعتماد المنهج الوصفي إطارًا لتحليل المعطيات وتفسيرها. وتكوّنت عيّنة الدراسة من ثلاثين (30) أخصائيًا في الأرطوفونيا يعملون في مؤسسات صحية عمومية وعيادات خاصة موزّعة عبر مختلف ولايات الوطن. وقد جُمعت البيانات من خلال استبيان أُعدّ خصيصًا لهذه الدراسة، تضمّن خمسة محاور رئيسية هي: المعلومات العامة، مقاربة إعادة تأهيل البروزوديا، تقييم والتكفّل بالبروزوديا، التكوين والمعرفة، والتحديات والتوصيات.
وأظهرت نتائج التحليلين الكمّي والكيفي للبيانات أنّ الأخصائيين الأرطوفونيين يولون اهتمامًا بالتكفّل المبكّر بالأطفال الصمّ المستفيدين من الزرع القوقعي، غير أنّ البروزوديا لا تحظى بالاهتمام الكافي ضمن البرامج العلاجية المعتمدة. وتدعو نتائج الدراسة إلى ضرورة تعزيز تكوين المختصّين في هذا المجال، وتطوير أدوات تدخّل تراعي الخصائص البروزودية للغة.

الكلمات المفتاحية: التكفل الأرطوفوني، البروزوديا، الأطفال الصم، الزرع القوقعي.

La réalité de la prise en charge orthophonique de la prosodie chez les enfants sourds porteurs d'un implant cochléaire en Algérie

Résumé :
Cette étude vise à examiner la réalité de la prise en charge orthophonique de la prosodie chez les enfants sourds bénéficiaires de l'implant cochléaire en Algérie. Pour atteindre cet objectif, nous avons adopté une approche descriptive permettant d'analyser et d'interpréter les données recueillies. L'échantillon de l'étude est composé de 30 orthophonistes exerçant dans des établissements hospitaliers publics et des cliniques privées, répartis à travers différentes régions du pays. Les données ont été collectées à l'aide d'un questionnaire élaboré pour les besoins de cette recherche, structuré autour de cinq axes principaux : Informations générales, approche de rééducation de la prosodie, évaluation et prise en charge de la prosodie, formation et connaissances, et défis et recommandations.
Les résultats des analyses quantitatives et qualitatives indiquent que les orthophonistes accordent une attention particulière à la prise en charge précoce des enfants sourds implantés. Toutefois, la dimension prosodique demeure insuffisamment intégrée dans les programmes thérapeutiques proposés. Les conclusions de l'étude soulignent la nécessité de renforcer la formation des professionnels dans ce domaine et de développer des outils d'intervention adaptés aux spécificités prosodiques de la langue.

Mots-clés : prise en charge orthophonique, prosodie, enfants sourds, implant cochléaire.

Introduction

Cochlear implantation is one of the modern medical options introduced in 2003 at The University Hospital of Mustapha Pasha in Algiers (Djennaoui & Shomala, 2021). This technique is intended for individuals with severe sensorineural hearing loss, particularly those who have not achieved sufficient benefit from traditional hearing aids after a period of intensive auditory rehabilitation. This complex electronic device works by transmitting sound information directly to the inner ear, thereby improving the individual's ability to perceive surrounding sounds (Deep el al., 2019). However, cochlear implants do not fully restore natural hearing ; they only enhance sound perception, which may lead to difficulties in interpreting received auditory signals.

Cochlear implant users face challenges in distinguishing sounds and understanding speech, as their processing of auditory signals differs from individuals with normal hearing. This is due to their auditory system lacking the full capacity to accurately discern subtle sound differences, leading to variations in perceiving word meanings and tonal nuances. Consequently, this affects their ability to communicate smoothly in daily life. A 2011 study by Lacheret demonstrated that prosody, a fundamental suprasegmental linguistic phenomenon, plays a key role in supporting everyday human communication. Since these individuals have spent extended periods in silent environments, they also lack sufficient auditory input, resulting in underdeveloped or disordered prosody.

There is no doubt that prosody plays a critical role in enhancing language and communication among deaf children, particularly those with cochlear implants. Prosody encompasses physical acoustic elements such as intonation, rhythm, and intensity, which contribute to improving emotional communication skills. This was confirmed by Scherer's (2003) study, which reveal the central role of prosody in expressing emotions through vocal cues, as emotions like joy, anger, and sadness can be distinguished based on tonal variations. This enhances social understanding and interaction for deaf children. Chin et al. (2012) emphasized that these elements are essential for grasping nuanced meanings and interpreting the expressive tone of speech, thereby enabling children to effectively articulate their feelings and thoughts. On the other hand, numerous studies, such as Van de Velde et al. (2018) have shown that strengthening prosodic skills is pivotal in developing the communicative abilities of deaf children with cochlear implants who are mainstreamed in classrooms. However, an Algerian field study conducted by Kacemi (2010) at schools for deaf children revealed that the majority of integrated deaf students exhibit disorders in prosodic voice characteristics, despite having acquired speech and language skills. This impedes their ability to communicate socially outside institutional settings.

Rehabilitating prosody in deaf children with cochlear implants presents a complex practical challenge, as hearing impairment fundamentally impedes their ability to discern prosodic differences and refine these skills. A Waterworthtl al (2022) emphasized that children with hearing impairments encounter additional hurdles in social integration and comprehending linguistic contexts, further highlighting the

critical need for specialized rehabilitation programs.

Hübscher&Prieto (2019) study, alongside other scientific literature, has underscored the critical role of prosody in enhancing social interaction and understanding linguistic messages across diverse contexts. To improve prosodic skills—thereby contributing to broader language performance adjustments and fostering social integration for deaf children—reliance is placed on technological tools proven effective in this domain. This is corroborated by studies such as Elhakeem et al. (2023), whose findings demonstrated that technological tools are highly beneficial and play a vital role in enhancing overall language abilities and prosody specifically among cochlear implant users, enabling them to integrate into their social environments. However, despite technological advancements in cochlear implants and other tools for auditory rehabilitation, successful prosodic rehabilitation also hinges on effective therapeutic programs and the personal expertise of speech-language pathologists (SLPs). Dornhoffer et al. (2022) study notes that SLPs' professional experience and academic training are pivotal in improving therapeutic outcomes for cochlear implant recipients, as trained specialists exhibit greater capability in designing rehabilitation programs tailored to patients' specific needs.

Success in caring for deaf individuals with cochlear implants is inherently linked to several factors beyond effective programs and specialist expertise. Chief among these is the need for field-based training for speech-language pathologists (SLPs) within a framework that ensures collaboration in multidisciplinary teams. Such partnerships help bridge gaps to provide comprehensive care for this population, as underscores by Roush & Wilson (2013), which emphasized the importance of a collaborative approach among multidisciplinary therapy teams to achieve improved outcomes in auditory and linguistic rehabilitation for deaf children.

From the above discussion, it becomes evident that prosody plays a vital role in distinguishing emotions and contextualizing speech, thereby supporting human communication and social interaction. However, in practice, prosody remains relegated to a secondary role in speech-language rehabilitation programs compared to other priorities, such as addressing speech articulation, pronunciation, and other linguistic or auditory challenges commonly faced by deaf individuals with cochlear implants.

This lack of emphasis on prosody as a core component of rehabilitation programs for deaf individuals may stem from insufficient training programs for specialists or the limited availability of tools and methods used in auditory-verbal re-education. Consequently, this article seeks to address these gaps through a comprehensive analysis of the current state of prosodic rehabilitation in speech-language therapy for cochlear implant recipients. The study aims to answer the central research question posed by our investigation:

Do speech-language pathologists (SLPs) employ specialized therapeutic protocols to rehabilitate prosody in deaf children with cochlear implants?

- Sub-Questions:

-Do speech-language pathologists (SLPs) possess sufficient expertise to address prosody rehabilitation?

-Do SLPs rely on technological tools and methods to rehabilitate prosody in deaf children cochlear implant ?

-Are the prosody rehabilitation programs used in practice adapted to the Algerian context?

- General Hypothesis:

Do speech-language pathologists use a standardized or specialized therapeutic protocol to rehabilitate prosody in deaf children with cochlear implants?.

- Sub-Hypotheses:

- SLPs lack sufficient expertise to address prosody rehabilitation.

- SLPs do not utilize technological tools and methods to rehabilitate prosody in deaf children cochlear implant.

- The prosody rehabilitation programs implemented are not adapted to the Algerian context.

1. Study Objectives

-To examine the current state of prosody rehabilitation in speech-language therapy for deaf children with cochlear implants.
-To assess the expertise level of speech-language pathologists (SLPs) in managing prosody rehabilitation.
-To investigate the extent to which modern technological tools and techniques are utilized in prosody rehabilitation practices and their impact on improving prosodic skills among deaf cochlear implant users.
-To evaluate the alignment of existing prosody rehabilitation programs with the cultural specificities of the Algerian context and determine the need to adapt them to local realities.

2. The study significance

2-1.Theoretical Significance

This study contributes to enriching scientific knowledge regarding prosody rehabilitation for deaf cochlear implant users, a field that has received insufficient attention in Algerian research.

2-2.Practical Significance

The findings of this study could serve as a valuable resource to encourage speech-language pathologists (SLPs) to prioritize prosodic aspects in their therapeutic practices for deaf cochlear implant users. This would enhance the efficacy of speech-language rehabilitation, ultimately improving the quality of life for these children by advancing their communication skills and supporting their social integration.

3. Definition of Terms Speech-language intervention

It is defined as a set of therapeutic techniques related to the speech chain, aimed at achieving general human and educational goals. The purpose of speech therapy care is to restore an individual's distinctive abilities and reintegrate them naturally. This approach relies on a prior agreement between the specialist and the patient, where the goals to be achieved are determined based on an initial speech therapy assessment preceding the treatment (Brin, 1997).

3-1. Prosody

Prosody is a level of linguistic representation at which the acoustic-phonetic properties of an utterance vary independently of its lexical items. This definition encompasses a variety of phenomena: emphasis, pitch accenting, intonational breaks, rhythm, and intonation (Wagner & Watson, 2010).

3-2. Deaf Children

A deaf child is defined as one whose hearing loss significantly affects auditory perception and communication, and who may rely on visual, auditory, or technological means for language development (Xie et al., 2014).

3-3. Cochlear Implant

An electronic device implanted behind the ear under the skin through a surgical procedure, designed to help individuals with severe hearing loss perceive sound. It stimulates the auditory nerve located in the middle ear, differing from hearing aids, which only amplify sound (Issa, 2010).

4-Field study procedures

4-1. Research Methodology

In this research, we relied on the descriptive method, which aims to provide an accurate description of the studied phenomenon by collecting quantitative or qualitative data and analyzing them adequately, this method requires a comprehensive interpretation of the facts, and the description is often associated with comparison and the methods of measurement, classification, and interpretation are employed to draw meaningful results and reach generalizations that can be applied to the phenomenon under study (Awad, 2002).

4-2. Study sample

The study sample consisted of 30 speech-language pathologists (speech therapists) from various regions of Algeria (North, South, East, and West). These professionals work either in private practices or in public healthcare centers. The sample was selected purposively, as the participants are directly involved in the management of individuals with cochlear implants. The recruitment process was carried out through email and Facebook groups dedicated to speech-language pathologists (SLPs) across Algeria. The study was conducted between 15 April 2024 and 24 November 2024. The characteristics of the sample are as follows: 50% of the professionals have less than five years of experience, 40% have between five and ten years of experience, and 10% have more than ten years of professional experience. With regard to academic qualifications, 66% of the participants hold a Master's degree, 23% hold a Bachelor's degree, and 10% hold a Doctorate. As for the age group primarily targeted in their therapeutic care, the majority of cases involved children with cochlear implants, with 47% of the practitioners working with children aged 0 to 6 years, and 37% with those aged 7 to 12 years.

4-3. Search tool

We designed a questionnaire based on previous studies in order to collect data in order to identify the reality of Speech therapy interventioncare for prosody in deaf children with cochlear implants through the viewpoint of Speech-language therapists. The questionnaire contained five axes, the first axis included general information, the second axis contained the approach to the rehabilitation of prosody, the third axis dealt with the evaluation of prosody, the fourth axis included training and special knowledge, and the fifth axis dealt with challenges and recommendations.

The questionnaire included a set of questions, including closed, semi-closed, semi-open, and open-ended questions addressed to archivists.

On the other hand, the questionnaire was subjected to an exploratory study to verify its psychometric properties through the following steps:

4-3-1.Validity of the tool

It was evaluated based on the honesty of the judges. The tool was presented in its initial version to professors specialized in the field from five different universities. Where they provided important feedback from which the questionnaire was modified.

Table 1. Expert Judges

Names of Expert Judges	University of Affiliation
Samir Fenni	Badji Mokhtar University – Annaba

Ilhem Sassane	Badji Mokhtar University – Annaba
Boukhmis Boufoula	Hadj Lakhdar University – Batna 1
Salah Kacemi	Djillali Bounaama University – Khemis Miliana
Tarek Salhi	KasdiMerbah University – Ouargla

4-3-2.Tool stability

To verify the reliability of the measurement instrument, the test-retest method was employed. The questionnaire was administered twice to the same sample, which consisted of 15 speech-language pathologists (speech therapists) selected from various geographic regions. A time interval of two weeks was set between the two administrations. This duration was chosen to minimize the influence of short-term memory on respondents, while maintaining the stability of the psychological and behavioral characteristics being measured.

After collecting the responses from both testing phases, the reliability coefficient was calculated using the SPSS software, resulting in a value of 0.92, which confirms the instrument's reliability and its suitability for achieving the objectives of the study.

5- Results

5-1.The first axis

This section is concerned with collecting general data about the speech therapy specialists participating in this study, focusing on their years of experience, academic level, professional framework of practice, geographical region of employment, as well as the age group they work with during rehabilitation sessions.

The aim of this section is to provide a comprehensive overview of the socio-professional characteristics of the studied sample, which will allow for the interpretation of their perceptions and practices in the following sections in light of their academic and field backgrounds.

In the Table 2, the results obtained from the questionnaire show that 50% of the sample have less than 5 years of experience, meaning 15 specialists from the total sample are considered early-career professionals. These findings suggest that most specialists are relatively new to the field, which may impact the quality of prosody rehabilitation for children with cochlear implants. Regarding experience levels of 5 to 10 years, 40% (12 specialists) fall into this category, representing a mid-career group with moderate

expertise. These professionals are considered the backbone of the field in Algeria, as they possess sufficient experience to handle complex cases effectively. Only 10% (3 specialists) have over 10 years of experience. The low number of highly experienced specialists indicates that the field is relatively new in Algeria or that challenges such as limited opportunities or lack of professional recognition may be driving experienced practitioners away from the field Regarding academic qualifications, 23% (7 specialists) hold a bachelor's degree (Licence). This group may either be recent graduates or represent the first generation of professionals who began practicing in this field. The majority of the sample—66% (20 specialists)—hold a master's degree, reflecting a clear shift toward specialization. This high percentage can be attributed to the increased availability, accessibility, and appeal of master's programs for students in this discipline. Only 10% (3 specialists) hold a doctoral degree (PhD), a small proportion that highlights a gap in scientific research, particularly related to prosody rehabilitation for deaf children.

Regarding work settings, 50% work in private practice, meaning 15 specialists operate in private practices ; 44% (13 specialists) are employed in hospitals, and 6% (2 specialists) work in specialized schools.

These findings highlight that private practice accounts for the largest share of specialists, reflecting a lack of institutional specialization. The extremely low proportion specialized schools (6%) and the absence of dedicated rehabilitation centers underscore a clear deficit in infrastructure for speech therapy rehabilitation.

Regarding geographical distribution, 26% of specialists (14 professionals) are located in the East, while the West also accounts for 26% (8 specialists). The North has 17% (5 specialists), and the South has only 10% (3 specialists). These results indicate a significant concentration of specialists in the Eastern and Western regions, suggesting relatively better availability of speech therapy services there. In contrast, the low percentage of specialists in the South (10%) highlights a stark disparity in access to these critical services.

Regarding the age groups for prosody rehabilitation, we obtained a percentage of 47% for the age group of 0–6 years, meaning 14 specialists work with this group; 37% for the age group of 7–12 years, equivalent to 11 specialists; 16% for the age group of 13–18 years, meaning only 5 specialists; and 0% for those over 19 years old.

Table 2. General information

How many years of experience do you have in the field of speech therapy?				
Less than 5 years	From 5 to 10 years		More than 10 years	
15	12		3	
50%	40%		10%	
What is your academic background in the field of speech therapy?				
Bachelor's degree (licence)	Master		Ph.D	
7	20		3	
23%	66%		10%	
In what setting do you work?				
Private practice	hospital	Specialized school	Rehabilitation center	Other
15	13	2	0	0
50%	44%	6%	0%	0%
In which region of Algeria do you practice your work?				
North (alger-tizi ouzou)	South (ouergla-biskra-laghouat)	the East (annaba-setif-batna-Constantine)	West (oran-tlemcen-sidi bel abbes)	
5	3	14	8	
17%	10%	47%	26%	
What is the most common age group you work with for prosody rehabilitation in deaf individuals?				
0-6 years	7-12 years	13-18 years	Over 19 years old	
14	11	5	0	
47%	37%	16%	0%	

The emphasis on the 0–6 age group (47%) underscores the critical role of early intervention in addressing prosody among deaf children. The gradual decline in focus on older age groups (7–12 and 13–18 years) reflects a reduced prioritization of these cohorts by specialists, likely due to the increased complexity of rehabilitation at later stages or a prevailing belief in the superior efficacy of early intervention. The complete absence of support for individuals over 19 years old highlights a systemic gap in providing lifelong prosody rehabilitation, leaving older populations with cochlear implants or persistent speech challenges without tailored care.

Through the analysis of the results from the first axis of the study, the following conclusions can be drawn:

-The novelty of the field and limited practical expertise, with 80% of participants having less than 5 years of experience, highlight the emerging status of speech therapy as a discipline in Algeria.

-The scarcity of long-term experienced specialists (10%) reflects systemic challenges in cultivating sustainable expertise, which may compromise the quality of care—

particularly for complex cases such as cochlear implant rehabilitation.
-Geographic disparities in service provision, with the majority of specialists concentrated in the East and West, contrasted by a stark shortage in the South (10%), underscoring unequal access to speech therapy services across regions.
Here, we note that Algeria demonstrates progress in developing academic expertise and raising awareness about the importance of early intervention. However, the field faces significant challenges, including limited practical experience, a lack of scientific research on prosody rehabilitation, uneven distribution of specialists across regions, and insufficient infrastructure. Additionally, the absence of targeted rehabilitation programs for older age groups underscores systemic gaps. These findings emphasize the urgent need to advance the field through enhanced training, equitable resource allocation, improved infrastructure, and comprehensive care for all age groups

5-2. The second axis

The aim of this section is to explore the practices and attitudes of speech therapy specialists toward prosody rehabilitation in deaf children, particularly those who have received cochlear implants.
It focuses on the extent to which specialists are aware of the importance of prosody as a fundamental component in speech therapy care, the vocal and rhythmic features emphasized during rehabilitation sessions, the technical methods used, and the extent to which modern technological tools are employed in this field.
From the obtained results, we find that only 13% consider the rehabilitation of prosody a priority. This means that only 4 specialists out of 30 view prosody as a central focus in caring for deaf children. This reflects a lack of awareness regarding the importance of prosody in improving the quality of communication for deaf children. Instead, specialists emphasize other linguistic and pronunciation aspects, such as words and sentences, at the expense of rhythmic and intonational elements.
23% (i.e., 7 specialists) consider it important only in specific cases, reflecting partial awareness of prosody's significance—likely limited to situations where clear rhythm and intonation issues are evident. Meanwhile, 64% (19 specialists) do not prioritize it, underscoring a general neglect of prosodic aspects. This lack of focus may stem from insufficient academic training or a shortage of specialized tools and programs in this domain.
Regarding the prosodic features targeted in rehabilitation sessions, we find that 33% (i.e., 10 specialists) focus on intonation, as it is considered a fundamental element for improving emotional expression and meaning in speech, which explains why specialists prioritize it over other aspects. Other features receive varying levels of emphasis: rhythm (13%), intensity (17%), melody (20%), and pauses (14%). This disparity in focus reflects differing priorities among specialists. The notably low emphasis on rhythm and pauses highlights a lack of awareness of their critical role in facilitating clear communication. This gap may be linked to insufficient training or undervaluation of these elements in therapeutic practices.

Table 3. Approach to Prosody rehabilitation

Do you give special importance to the rehabilitation of the Prosody to care for the deaf child?						
Yes, it is a priority		Yes, but only in some cases		I don't focus on other aspects		
4		7		19		
13%		23%		64%		
What characteristics of Prosody do you focus on in rehabilitation sessions?						
Intonation	The rhythm	Distress	Melody	speed	Duration	Pauses and stillness
10	4	5	6	0	1	4
33%	13%	17%	20%	0%	3%	14%
What educational reasons do you use to deal with Prosody?						
Auditory sound models	Audio recordings for feedback	Rhythmic and musical exercises	Use visual tools	Innovative technologies		
4	9	10	4	3		
13%	30%	33%	14%	10%		
Do you use technological tools to support Prosody rehabilitation?						
Yes, regularly	Yes sometimes	no				
0	10	20				
0%	33%	67%				

Regarding speed (0%) and duration (3%), the absence of focus on speed and limited attention to duration reflect a lack of awareness of these features' role in enhancing the overall rhythm of speech.

As for the educational methods used to address prosody, 33% (10 specialists) employ rhythmic and musical exercises. While this percentage demonstrates a solid understanding of how rhythmic training can improve prosody, its application remains limited relative to the total number of specialists. This suggests a need for broader adoption of such methods or further training to integrate them effectively into therapeutic practices.

30% (9 specialists) use audio recordings for feedback, emphasizing the critical role of auditory review in enhancing prosodic performance. However, only 13% rely on auditory models, a low percentage that reflects limited adoption of direct modeling techniques, likely due to insufficient training or resource constraints. Meanwhile, 14% (4 specialists) employ visual tools, and 10% (3 specialists) utilize innovative techniques. These low adoption rates highlight a lack of emphasis on visual aids and innovative approaches, which could significantly benefit children with voice disorders. The gap underscores the need for greater investment in training, resources, and awareness to

integrate these underutilized yet impactful methods into therapeutic practices.
Regarding the use of technological tools to support rehabilitation, 0% of specialists use technological tools regularly, indicating a significant absence of technology as part of the rehabilitation process. This likely stems from a lack of training on incorporating technology into therapeutic sessions.
From the table above, we obtained that 33% use technological tools, sometimes equivalent to 10 specialists. This occasional use reflects individual attempts to benefit from technology without the existence of an integrated system to support these efforts.
67% (20 specialists) do not use technological tools, indicating a lack of awareness or insufficient availability of appropriate tools in their workplaces, which undermines the quality of therapeutic interventions.
Through the results obtained from the second axis, we conclude that there is a lack of interest in rehabilitating the Prosody. The results show that the Prosody does not receive priority in caring for deaf children, which reflects a lack of specialized training in this field. We also conclude that there is a disparity in the focus on the characteristics of the Prosody, as intonation receives priority among specialists, while speed and duration are neglected almost in general, which reflects the lack of comprehensiveness in the rehabilitation approach. There is also a limitation in the use of advanced methods. We find that there is a heavy reliance on exercises. Rhythmic and audio recordings, while the use of visual tools or innovative technologies is low, which may affect the effectiveness of the sessions. We also conclude that the absence of technological tools reflects the lack of regular use of technology and reflects the lack of resources or training in this aspect, which hinders deaf children with modern interventions.

5-3. The third axis

This section focuses on the assessment tools used by speech therapy specialists to evaluate prosody in deaf children who have received cochlear implants. It also addresses the therapeutic practices adopted in the management of this linguistic phenomenon.
The section examines the evaluation tools and their level of difficulty, as well as the extent to which the therapeutic programs used are adapted to the Algerian linguistic environment, and the use of modern software in supporting therapeutic decision-making.
In the Table 4, the results of the third axis, which examines the assessment tools used to measure the progress of Prosody (presumably a methodology or process), indicate that 13% (4 specialists) rely solely on standardized cognitive tests, reflecting a shortage of suitable tools or their incompatibility with the Algerian context, which drives the adoption of alternative technical approaches. Meanwhile, 33% utilize voice analysis through the software PRAAT, a free and accessible tool that enables precise measurements of vocal characteristics (e.g., pitch, frequency, intensity), underscoring specialists' recognition of technology's role in sound analysis, despite the absence of integration with other tools. Notably, 0% employ locally adapted tools designed for the Algerian environment, revealing a critical gap in research and development of culturally

and linguistically appropriate assessment tools. Additionally, 53% of specialists depend on comparative recordings, a widely used and straightforward method that avoids complex techniques, though it may lack the precision of standardized tools or advanced software. These findings highlight both the pragmatic adaptations of available resources and the pressing need for context-specific innovations in assessment practices.

Regarding the second question of the third axis, we note the absence of frequent evaluation, reflecting a lack of awareness of the importance of precise monitoring or possibly work pressure and limited resources. 30% of specialists conduct evaluations weekly, a practice that is relatively rare and may stem from needs, time constraints, or the specialist's efficiency. Meanwhile, 70% rely on monthly evaluations, with this majority preference indicating a trend toward periodic assessments rather than continuous monitoring. This approach may reduce the ability to adjust therapeutic programs based on observed language development progress.

The survey results also indicate that 61% of specialists face difficulty in assessing intonation due to its complexity and dependence on the harmony between tone, rhythm, and other acoustic factors. 30% identify intonation as a challenge because it requires precise skills to perceive vocal changes and link them to linguistic expression in varying rhythm (6%) and intensity (3%). These aspects may be less challenging as they are more assessable using tools like PRAAT or audio recordings.

70% of specialists believe that therapeutic programs are not adapted, reflecting a gap between the available therapeutic content and the needs of deaf children in Algeria. This may stem from reliance on foreign programs not designed for the local culture and language. Only 30% consider the programs adapted, highlighting individual efforts to customize them, though these remain insufficient to address broader challenges.

Additionally, 94% of specialists do not use the the VOC program, indicating a lack of awareness or resources to access it, despite its benefits in analyzing vocal development in deaf children. The fact that only 6% use it underscores the limited availability or inadequate accessibility of advanced technologies in this field.

The survey results reveal that 76% of specialists use the (M.V.T) method. This high percentage indicates an awareness of the method's importance in improving vocal and prosodic expression, reflecting relative success in applying such techniques. Meanwhile, 24% do not use it, which may be attributed to a lack of training or understanding of its role in rehabilitation. Additionally, only 25% employ the (T.M.R) method.

Table 4. Evaluation and management of Prosody

What assessment tools do you use to measure Prosody progress?			
Standardized cognitive tests	Audio analytics through Praat	Local tools or non-standardized tests	Compare recordings
4	10	0	16
13%	33%	%0	53%

What is the frequency of evaluation for Prosody in your patients?		
In every session	Weekly	monthly
0	9	21
0%	30%	70%

What characteristics do you find most difficult to evaluate?			
Intonation	The rhythm	Distress	Melody
9	2	1	18
30%	6%	3%	61%

Are the therapeutic programs used adapted to the Algerian environment?	
Yes	no
9	21
30%	70%

Do you use th.voc information software in your assessment of the voice of deaf people?	
Yes	no
2	28
6%	94%

Do you use the tonal verbal method in your program for the deaf?	
Yes	no
23	7
76%	24%

Do you use TMR technology to care for a deaf person?	
Yes	no
5	16
25%	85%

What can be concluded from this axis is that there is relative progress in the use of technologies like PRAAT, but significant challenges persist in comprehensively addressing prosody in deaf children. These challenges include limited resources, a lack of adapted tools, and underutilization of advanced technology, all of which contribute to difficulties in evaluating certain prosodic characteristics.

5-4. The fourth axis

This section addresses the availability of specialized training for speech therapists in the

field of prosody rehabilitation, particularly when working with children who have received cochlear implants.
It also investigates the adequacy of academic or educational training in covering aspects of vocal and rhythmic intervention, and assesses the extent to which specialists possess the technical and pedagogical tools necessary to effectively implement rehabilitation programs in practice.

Table 5. Training and special knowledge

Have you received special training on prosodic rehabilitation for deaf people with cochlear implants?		
During the university course	Through ongoing training courses	I did not receive any configuration
0	19	11
%0	63%	%36
Do you think that the training you received is sufficient to deal with such situations?		
Yes	No	
0	30	
0%	100%	
Do you have the necessary means to provide effective insurance?		
Yes	No	
3	27	
10%	90%	

From the results of the fourth axis, we note a complete absence of specialized courses or educational programs for prosody rehabilitation, reflecting shortcomings in the university curriculum for speech therapy (orthophony) in Algeria, which may stem from academic programs prioritizing general aspects over specialized training in prosodic elements relevant to deaf cochlear implant users. 63% (19 specialists) reported receiving training through continuous courses, highlighting personal initiatives by some specialists to develop their skills and indicating an awareness of the field's importance. Conversely, 36% (11 specialists) received no training, a significant gap that hinders their ability to deliver effective interventions in prosody rehabilitation. A 0% consensus on the adequacy of training underscores the lack of depth or proper coverage of concepts and techniques related to prosody rehabilitation, further emphasizing the urgent need to develop specialized programs tailored to the needs of this population. These findings collectively reveal systemic challenges in training and resource allocation, necessitating targeted reforms to address gaps in prosody rehabilitation for deaf children in Algeria.
The results reveal that only (10%) of the sample possess the necessary resources to provide adequate care, indicating that few specialists work in equipped environments that enable the use of tools and resources essential for effective intervention. 90% lack these resources, reflecting a severe shortage of material and technical means, such as

technological programs, assistive devices, or educational resources. This may result from limited funding or insufficient official attention to equipping speech therapy centers with modern tools.

The findings of this axis highlight several fundamental challenges in prosody rehabilitation for deaf cochlear implant users, underscoring weaknesses in academic training and the urgent need for comprehensive, ongoing professional development. 63% of specialists, despite receiving continuous training, acknowledge its inadequacy, emphasizing the necessity to improve the quality and scope of training programs. Additionally, the lack of resources in centers makes it difficult to implement effective interventions that meet the needs of deaf cochlear implant users.

Specialists' limitations stem not only from their lack of experience but also from insufficient training and material support, which negatively impacts the quality of care provided. These systemic gaps call for immediate reforms to address both educational and infrastructural deficiencies in this critical field.

5-5. The fifth axis

This section aims to shed light on the main challenges faced by speech therapy specialists in rehabilitating prosody in deaf children with cochlear implants. These challenges may include a lack of specialized training, the absence of appropriate equipment, or insufficient educational and technical adaptation of therapeutic programs. It also provides practitioners with the opportunity to propose practical recommendations based on their field experience, with the goal of improving the quality of therapeutic intervention, developing care practices, and reducing institutional barriers that limit the effectiveness of speech therapy in this area.

In the Table 6, regarding the results obtained in this axis, we note that 6% of the sample face difficulties in achieving tangible progress. This low percentage reflects that the primary challenge lies not in specialists' ability to stimulate case comprehension but rather in other factors, such as a lack of resources and support, suggesting that better outcomes could be achieved if appropriate tools were available. 50% of respondents reported a lack of suitable technological resources, a high percentage that highlights a significant challenge due to the absence of technological tools (e.g., audio software, assistive devices for sound analysis, and prosody rehabilitation). This is attributed to insufficient funding, the unavailability of advanced devices, or the ineffective utilization of existing technology. 30% pointed to limited collaboration with other professionals (e.g., physicians, audiologists, and speech therapists), reflecting a lack of an integrative, multidisciplinary approach and poor coordination among therapeutic teams, which negatively impacts the effectiveness of rehabilitation programs. These findings underscore systemic obstacles rooted in resource scarcity, technological gaps, and fragmented professional collaboration, all of which hinder the delivery of comprehensive and effective prosody rehabilitation for deaf cochlear implant users.

Table 6. Recommendations and challenges.

What are the main challenges faced in prosodic rehabilitation in cases of deafness with cochlear implants?			
Difficulty achieving tangible progress	Lack of appropriate technology resources	Lack of cooperation with other professionals	Difficulty in adapting rehabilitation to each patient
2	15	10	3
6%	50%	30%	10%
What recommendations do you offer to improve Prosody rehabilitation in these cases?			
Providing more specialized configurations in Prosody	Develop new assessment tools	Increase the use of modern technology in rehabilitation	Promote the multidisciplinary approach
4	8	18	0
13%	26%	60%	0 %

10% of the sample indicate difficulty in tailoring rehabilitation to each patient, highlighting challenges in designing customized therapeutic programs that align with the needs and circumstances of each child, which requires intensive training and extensive expertise.

Regarding the recommendations proposed by specialists in the field, 13% advocate for providing more specialized training, a percentage that reflects modest interest in this aspect, indicating practical challenges in delivering such training. 26% emphasize the development of new assessment tools, highlighting a clear demand to improve the evaluation tools currently in use. This moderate percentage underscores specialists' awareness of the need for more precise and modern tools to assess prosody. These findings collectively reveal a focus on addressing gaps in both training quality and assessment methodologies, pointing to the necessity of systemic enhancements to advance prosody rehabilitation practices.

60% advocate for increasing the use of modern technology in rehabilitation, making this the most prevalent recommendation among participants. This underscores a strong awareness of technology's critical role in enhancing therapeutic outcomes and streamlining case management.

0% prioritize strengthening a multidisciplinary approach, with no interest in this recommendation, likely reflecting limited familiarity with or practical implementation of multidisciplinary frameworks in prosody rehabilitation. This outcome may signal the necessity to raise awareness about the benefits of cross-disciplinary collaboration (e.g., between audiologists, speech therapists, and educators) to improve care quality. These findings highlight a stark contrast between the high demand for technological integration and the neglect of interdisciplinary strategies, both of which are vital for holistic and effective rehabilitation practices.

6. Discussion of Results in Light of the Study Hypotheses

6-1.Discussion of the First Hypothesis Results

Hypothesis text: speech-language pathologists (SLPs) do not employ specialized therapeutic protocols to rehabilitate prosody in deaf children with cochlear implants. The validity of the hypothesis was confirmed through the results shown in Table 6.
The results of the questionnaire directed at speech therapists in Algeria regarding the reality of prosody rehabilitation for deaf children with cochlear implants indicated that specialists in the field often rely on individual practices based on their personal experience.
International statistics, such as the Waterworthtl al (2022) report, indicate that 80% of deaf children in developing countries do not receive comprehensive rehabilitation services due to a lack of resources. This issue is also evident in Algeria, where the results confirmed that specialists lack the necessary tools for effective intervention.
In addition to the lack of interdisciplinary collaboration, the absence of a multidisciplinary approach hinders comprehensive care. Despite this, a study by Otero(2024).demonstrated that interdisciplinary collaboration improves therapeutic outcomes by up to 45%.

6-2.Discussion of the Second Hypothesis Results

Hypothesis Statement: Speech therapists do not have sufficient training and experience to manage prosody rehabilitation.
The validity of this hypothesis was confirmed through the results obtained in Table 1 and Table 5, which demonstrate that the lack of specialized training and experience among speech therapists directly affects the quality of prosody rehabilitation for deaf children.
Addressing these gaps requires a comprehensive approach that includes academic training, scientific research, and continuous professional development to enhance skills and better meet the needs of speech therapy rehabilitation. The results showed that the majority of specialists have less than 10 years of experience, with an almost complete absence of PhD holders. This reflects a lack of scientific and research expertise, factors that have been highlighted in studies such as that of Dornhoffer et al. (2022), as essential for improving the quality of care. The study found that experience increases the effectiveness of therapy by up to 30%.

6-3. Discussion of the Third Hypothesis Results

Hypothesis Statement : Speech therapists do not rely on technological tools and methods for prosody rehabilitation in deaf individuals.
The validity of this hypothesis was demonstrated through the results presented in Table 3, which highlight a significant gap in prosody rehabilitation for deaf children with

cochlear implants. Most specialists indicated that they do not consider prosody a priority in rehabilitation programs. This reflects a lack of awareness regarding the importance of prosody as a fundamental element in enhancing verbal communication skills, particularly for children who rely on cochlear implants to regain part of their auditory abilities.

Although some specialists use methods such as audio recordings and musical exercises as part of their therapy programs, the use of advanced technological tools, such as the Praat software, remains limited. Praat, a leading tool in speech and prosody analysis, plays a crucial role in improving assessment accuracy and developing effective rehabilitation strategies.

According to Hübscher&Prieto(2019), the integration of technology can enhance assessment accuracy by up to 40%, underscoring the significant technological gap in speech therapy practices in Algeria.

6-4.Text of the fourth hypothesis

Hypothesis Statement : The programs used for prosody rehabilitation are not adapted to the Algerian context.

The validity of this hypothesis was confirmed through the results presented in Table 4, which highlight several fundamental challenges that hinder effective prosody rehabilitation for deaf children with cochlear implants in Algeria. These challenges negatively impact the quality of linguistic and social rehabilitation.

One of the most significant obstacles is that 70% of rehabilitation programs are not adapted to the local linguistic and cultural environment, reducing their effectiveness in addressing the needs of deaf children within the Algerian context. This finding aligns with Pollard (2009), who emphasized that using locally adapted tools and programs can improve outcomes by up to 35%.

This lack of adaptation reflects an overlooked need for developing rehabilitation solutions that consider Algeria's linguistic and cultural diversity, which is essential for improving the effectiveness of therapeutic interventions.

7. Limitations

This study presents four main limitations that should be taken into account when interpreting its findings. First, the sample size was relatively small, due to low response rates from speech-language pathologists despite repeated dissemination of the questionnaire across professional orthophony groups. This limited the statistical representativeness compared to the actual number of specialists in Algeria. Second, the study did not deeply address the impact of linguistic and dialectal diversity in Algeria, although it constitutes a key factor in prosody rehabilitation. Variations in rhythm, intonation, and stress between Standard Arabic, Algerian Darija, Amazigh, and French may influence therapeutic practices and outcomes. Third, there was insufficient

participation from specialized institutions, such as cochlear implant centers and schools for the deaf, which restricted the practical validation of field-related data. Fourth, the sample showed a geographical concentration in the eastern region of Algeria, with limited representation from other areas. This imbalance resulted from easier access to professionals in the east and lower engagement from those in western and southern regions. Despite these limitations, the findings retain considerable scientific value and serve as a preliminary foundation for future research with broader and more linguistically and geographically diversified samples.

8. Conclusion

The results of the questionnaire revealed significant obstacles to prosody rehabilitation for cochlear-implanted deaf children in Algeria. These obstacles are primarily based on a lack of training and expertise among specialists, in addition to limited technological resources and the misalignment of therapeutic programs with the local cultural and environmental context.

These challenges not only lead to reduced treatment effectiveness but also contribute to delays in the development of linguistic and communication skills, hindering the full social integration of children. To overcome these obstacles, it is essential to adopt a multi-faceted strategy that focuses on strengthening academic and continuous professional training for specialists. This training must be comprehensive and tailored to meet the needs of deaf children, with an emphasis on practical training and the use of modern technologies. Additionally, providing advanced technological tools, such as hearing devices and specialized prosody processing software, is crucial.

These tools should be designed to fit the cultural and linguistic particularities of Algeria. Furthermore, interdisciplinary collaboration can contribute to improving the quality of prosody rehabilitation. This type of collaboration facilitates the exchange of expertise and knowledge, enhancing the efficiency of therapeutic interventions.

The integrated implementation of these measures does not only improve the services provided to cochlear-implanted deaf children but also helps bridge the gap between local capabilities and global best practices, enabling these children to develop their skills and achieve better social integration.

This study examined the reality of speech therapy intervention in the rehabilitation of prosody in cochlear-implanted deaf children in Algeria, with a particular focus on the role of speech-language therapists in improving prosodic features such as intonation, rhythm, and intensity. Using a questionnaire administered to thirty practicing speech-language therapists, the results revealed that prosody rehabilitation is not prioritized by specialists, thereby confirming the validity of our hypotheses :

- Speech therapists do not use specialized therapeutic protocols for prosody rehabilitation.
- Speech-language therapists lack sufficient expertise to effectively manage prosody rehabilitation.

- Specialists do not rely on technological tools and methods for prosody rehabilitation in cochlear-implanted deaf children.
- The rehabilitation programs used are not adapted to the Algerian environment.

Based on these findings, there is a clear need to expand research to include larger samples, allowing for more comprehensive results.

Promoting collaboration among multidisciplinary therapy teams, as these factors contribute to improving the quality of prosody rehabilitation. Such efforts can help enhance the linguistic and social communication of deaf children and increase their opportunities for integration into society.

References

- Brin, F., Catherine, F., & Courier. (1997). *Dictionnaire orthophonique*. ortho-Édition.
- Chin, S. B., Bergeson, T. R., & Phan, J. (2012). Speech intelligibility and prosody production in children with cochlear implants. *Journal of Communication Disorders*, 45(5), 355–366. https://doi.org/10.1016/j.jcomdis.2012.05.003
- Deep, N. L., Dowling, E. M., Jethanamest, D., & Carlson, M. L (2019). Cochlear implantation: An overview. *Journal of Neurological Surgery* B: Skull Base, 80(2), 169–177. https://doi.org/10.1055/s-0038-1669411Available at: http://www.gulfkids.com
- Djennaoui, DJ. & Shomala, A.N. (2021). *400 Cochlear Implant Surgeries in Algeria and the Call for Local Manufacturing to Address the Shortage.* Algerian Radio. Available at:https://radioalgerie.dz/news/ar/article/20210424/210538.html
- Dornhoffer, J. R., Reddy, P., Ma, C., Schvartz-Leyzac, K. C., Dubno, J. R., &McRackan, T. R. (2022). Use of auditory training and its influence on early cochlear implant outcomes in adults. *Otology &Neurotology*, 43(2), e165–e173. https://doi.org/10.1097/MAO.0000000000003417
- Elhakeem, E. S., Elmaghraby, R. M., & Ibrahim, S. M. (2023). Objective measurement of prosodic features of speech of hearing-impaired Egyptian children with cochlear implants. *The Egyptian Journal of Otolaryngology*, 39, Article 41. https://doi.org/10.1186/s43163-023-00400-8
- Hübscher, I., & Prieto, P. (2019). Gestural and prosodic development act as sister systems and jointly pave the way for children's sociopragmatic development. *Frontiers in Psychology*, 10, Article 1259. https://doi.org/10.3389/fpsyg.2019.01259
- Issa, A. N. (2010). *Cochlear implantation for deaf children*. Jordan: Dar Al-Fikr for Publishing and Distribution.p.66.
- Kacemi, S. (2010). *La rééducation de la prosodie chez l'enfant sourd bénéficiaire d'un implant cochléaire.* Conférence présentée au siège de la Société Algérienne d'Orthophonie et de Rééducation (SAOR), Dely Ibrahim (ProsodyRehabilitation in Cochlear-ImplantedChildren)

- Otero, C. B. (2024). Interdisciplinary work: essential for optimising hearing implant outcomes. *Auditio*, 8, e91. https://doi.org/10.51445/sja.auditio.vol8.2024.0091
- Pollard Jr., R. Q. (2009). *Adapting health education material for deaf audiences*. Retrieved from

  https://cssh.northeastern.edu/cali/wp-content/uploads/sites/57/2022/09/Adapting-health-education-material-for-deaf-audiences.pdf
- Roush, J., & Wilson, K. (2013). Interdisciplinary assessment of children with hearing loss and multiple disabilities. *Perspectives on Hearing and Hearing Disorders in Childhood*, 23(1), 13-26. https://doi.org/10.1044/hhdc23.1.13
- Scherer, K. R. (2003). Vocal communication of emotion: A review of research paradigms. *Speech Communication*, 40(1–2), 227–256. https://doi.org/10.1016/S0167-6393(02)00084-5
- Van de Velde, D. J., Schiller, N. O., Levelt, C. C., Van Heuven, V. J., Beers, M., Briaire, J. J., &Frijns, J. H. M. (2018). Prosody perception and production by children with cochlear implants. *Journal of Child Language*, 46(1), 111–141. https://doi.org/10.1017/S0305000918000387
- Wagner, P., & Watson, D. G. (2010). Experimental and theoretical advances in prosody: A review. *Language and Cognitive Processes*, 25(7–9), 905–945. https://doi.org/10.1080/01690961003589492
- Waterworth, C., Marella, M., O'Donovan, J., & Bright, T. (2022). Barriers to access to ear and hearing care services in low- and middle-income countries: A scoping review. *Global Public Health*, 17(10), 1-25. https://doi.org/10.1080/17441692.2022.2053734
- Xie, Y.-H., Potměšil, M., & Peters, B. (2014). Children who are deaf or hard of hearing in inclusive educational settings: A literature review on interactions with peers. *Journal of Deaf Studies and Deaf Education,* 19(4), 423–443. https://doi.org/10.1093/deafed/enu017.