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The Design and Evaluation of Children's Speech Recognition Audiometry Listsin Moroccan Dialect

Myriam Loudghiri [a*], Meryem Mourai [a], Youssef Oukessou [a], Sami Rouadi [a], Redallah Abada [a], Mohamed Roubal [a] and Mohamed Mahtar [a]

[a] Otorhinolaryngology and Head and Neck Surgery Department, IBN ROCHD University Hospital, Faculty of Medicine and Pharmacy, Hassan II University, Casablanca, Morocco.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Objectives:
- To develop mono and bisyllabicspeech recognition audiometry lists in Moroccan dialect with corresponding picture boards adapted to morrocan children from 3 to 5 years old.
- To develop and record children's speech recognition audiometry lists in Moroccan dialect, adapted to children aged 6 and over.
- To test these lists on a sample of normal hearing Moroccan children in order to evaluate their reliability and validate them.

Materials and Methods: First of all, the linguistics laboratory created lists of monosyllabic et dissyllabic words in Moroccan dialect based on the Arabic speech audiometry lists. Then they created picture boards adapted to the lists.

**Corresponding author: E-mail: m.loudghiri@hotmail.com;*

The 2nd step was to validate this lists (word lists and picture boards) within a sample of normal hearing Moroccan children: This involved verifying that tonal audiometry was normal, then verifying that the words selected were common and well-known to children of this age, and finally verifiying that the pictures selected were well-know and adapted to the words.
During the study, the world lists and picture boards were tested in a university hospital otolaryngology service (Hospital 20 Août of Casablanca)and corrected (84 enfants).
Results: Twenty illustrated speech recognition audiometry lists intended for moroccan children from 3 to 5 years old and 20 recorded speech recognition audiometry lists intended for moroccan children from 6 years old was created.
All recorded words/pictures and words have been recognized by the children. The 40 lists evaluated made it possible to collect audiometry results speech consistent with the results of pure-tone audiometry.
Conclusion: At the end of this study, 20 illustrated speech recognition audiometry lists intended for moroccan children from 3 to 5 years old and 20 recordedspeech recognition audiometry lists intended for moroccan children from 6 years old have been validated in normal-hearing children. This is a first step before the validation of these lists in deaf children and by extension in children with cochlear implants.

Keywords: Audiometery; bisyllabic; monosyllabic; psychomotor development.

1. INTRODUCTION

Subjective audiometry allows the exploration of the different auditory pathways with the help of an acoustic stimulus. In children, it must take into account a certain number of parameters whose combination determines different audiometric strategies. This is called behavioral audiometry.

Pure tone audiometry explores hearing with a sound stimulus made of pure tones, voice audiometry requires the use of well-chosen words to complete the hearing exploration tests [1-3].

Indeed, voice audiometry in children has several interests in clinical practice, including:

A diagnostic interest: It confirms the results of the tonal audiometry by making it possible to control it and predicts the participation of the perception apparatus each time there is a deformation of the intelligibility curve.

A social interest: The deafness disturbs the deaf child, and can affect his school life, but the tonal audiometry can only give an idea on the depth of deafness and the possible site of hearing impairment but cannot assess the social problems that the deaf child may encounter in his daily life, this is the case for children with either a language delay or speech disorders or a delay in school / hyperactivity in which the diagnosis of deafness has gone unnoticed.

Behavioral audiometry allows us to show several cases of patients who have only a minimal hearing loss in tonal audiometry, but who present serious problems of intelligibility and speech comprehension. This is the case of central hearing impairment that can be seen in late onset genetic deafness.

An interest in the follow-up: In the post-operative follow-up, speech audiometry objectifies and quantifies the hearing gain after surgery. It is particularly useful for children in post cochlear implant follow-up.

A prosthetic interest: Speech audiometry allows audio prosthesisto judge the prosthetic possibilities much better than with the information obtained by tone audiometry and also helps in the prosthetic adjustments.

In our daily practice, the majority of Moroccan otologists do not use this voice audiometry test in children. This is mainly due to the fact that the word lists are not adapted to the child: words not used or not known by the child.

1.1 Objectives

This study has 3 objectives:

- To elaborate mono and bi-syllabic speech recognition audiometry lists in Moroccan dialect, adapted to children from 3 to 5 years old, which can be represented by corresponding picture boards, allowing the screening of auditory disorders in children from 3 years' old who cannot repeat the word, must be able to point to the corresponding picture.

- Develop and record monosyllabic and bi-syllabicspeech recognition audiometry lists in Moroccan dialect, adapted to children aged 6 years and older, who will be able to recognize and repeat them in recorded voice.
- To test these lists on a sample of normal hearing Moroccan children in order to evaluate their reliability and to validate them.

2. MATERIALS AND METHODS

2.1 Elaboration of Speech Recognition Audiometry Lists Adapted to the Child

The elaboration of speech recognition audiometry listswas based on lists in the literature,

The Design of the lists was made according to 2 populations: group A (children between 3 and 5 years old), group B (children 6 years old and more)

For the choice of words: the words were first written in Arabic letters, translated according to their meaning in French, then transcribed according to the international phonetic transcription.

For the conception of the lists: the words were divided according to the number of syllables, the syllabic architecture, and the lexical field. A proportional count of these different parameters was calculated and distributed equally between each list. The phonetic complexity index was respected as proposed by Jakielsky (2000).

2.2 Recording of the Lists

The recording of the words was done by professional voice-overs (male and female voices), in a professional studio, and with the collaboration of a sound engineer, in accordance with the ISO 8253-3 standard, the words, thereafter, were integrated into an audiogram, of the brand AD629 of Interacoustics.

2.3 Development of Picture Boards

Picture identification is a widely used technique for the description of children's known vocabulary, this technique based on pictures representing objects that we make sure during the pretest are known to the child, allows us to detect auditory difficulties if the child has not heard the word and hesitates to point out the corresponding object. The lists intended for the children of group A (aged 3 to 5 years).

Weconstituted 10 boards of recognizable images from the age of three years (Fig. 1).

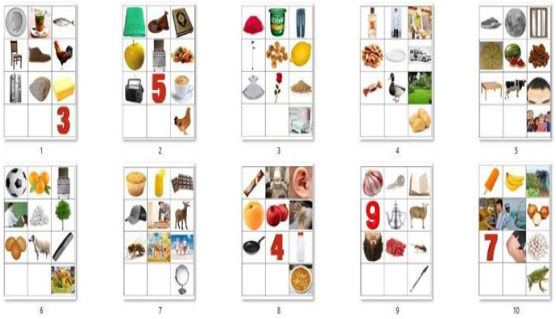

Fig. 1. Example of images developed for the children's lists

The constraints were representability: excluding all abstract words, and simplicity of identification: the images had to have only one common name (the unknown images were changed by other more significant ones) (Fig. 2).

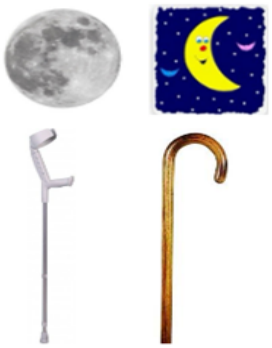

Fig. 2. Example of changed pictures

2.4 Evaluation of the Lists

For the evaluation of these lists, 84 normal hearing children aged 3 to 12 years were recruited at the ENT department of University Hospital 20 August in Casablanca. The tests were performed in an audiometric booth and room as quiet as possible, with an audiometer and built-in microphone connected to two loudspeakers. The word lists (Fig. 3) were tested within the 84 children.

The test was performed by an ENT doctor experienced in audiological testing of children (behavioral audiometry).

1- Lists designed for Group A children (ages 3 to 5)

Monosyllabic lists

Liste 1			liste 2			liste 3			liste 4			Liste 5		
1- CVCV	حوتة	fish	1- CVCV	فوطة	towel	1- CVCV	صابة	skirt	1- CVCV	ريحة	parfum	1- CVCV	باطو	boat
2-CVCVC	أتاي	tea	2-CVCVC	طاجين	tajine	2-CVCVC	دانون	yogurt	2-CVCVC	بوليس	police	2-CVCVC	قمر	moon
3-CvCCVC	درهم	dirham	3-CvCCVC	قرآن	quran	3-CvCCVC	سروال	pant	3-CvCCVC	بناي	shaaban	3-CvCCVC	شرجم	window
4-CvCCVC	فروج	chicken	4-CvCCVC	تفاح	apple	4-CvCCVC	عكز	numbers	4-CvCCVC	كاوكاو	cacao	4-CvCCVC	بغرير	baghrir/mo
5-CvCCVC	صباط	shoe	5-CvCCVC	فران	oven	5-CvCCVC	كركاع	walnut	5-CvCCVC	طبسيل	plate	5-CvCCVC	دلاح	watermelon
6-CVCCV	كرسي	chair	6-CVCCV	خضرة	vegetable	6-CVCCV	حامضه	lemon	6-CVCCV	طاكسي	taxi	6-CVCCV	شبكة	basket
7-CVCCV	زبدة	butter	7-CVCCV	راديو	radio	7-CVCCV	كسوة	dress	7-CVCCV	حلوة	cookies	7-CVCCV	طبلة	table
8-CVCCV	حجرة	rock	8-CVCCV	خمسة	five	8-CVCCV	وردة	rose	8-CVCCV	بطة	goose	8-CVCCV	بقره	cow
9-CVCCV	بقرة	cow	9-CVCCV	قهوة	coffee	9-CVCCV	رملة	sand	9-CVCCV	جردة	garden	9-CVCCV	جبهه	forehead
10-X	تلاتة	three	10-X	دجاجة	chicken	10-X	سبيطار	hospital	10-X	بطاطا	potato	10-X	دراري	children

Liste 6			liste7			liste8			liste 9			Liste 10		
1- CVCV	كورة	ball	1- CVCV	كيكة	cake	1- CVCV	بيمو	biscuit	1- CVCV	توما	garlic	1- CVCV	بولو	icecream
2-CVCVC	ليمون	orange	2-CVCVC	عصير	juice	2-CVCVC	صالون	living room	2-CVCVC	ساروت	key	2-CVCVC	بانان	banana
3-CvCCVC	فران	oven	3-CvCCVC	شكلاط	chocolate	3-CvCCVC	وذنين	ears	3-CvCCVC	دفتار	notebbok	3-CvCCVC	فلاح	farmer
4-CvCCVC	أستاذ	professor	4-CvCCVC	طربوش	hat	4-CvCCVC	مشماش	apricot	4-CvCCVC	تسعود	nine	4-CvCCVC	عطار	parfumer
5-CvCCVC	سكار	sugar	5-CvCCVC	نجار	carpenter	5-CvCCVC	رمان	grenade	5-CvCCVC	براد	tea-pot	5-CvCCVC	صياد	le chasseur
6-CVCCV	شجرة	tree	6-CVCCV	معزة	goat	6-CVCCV	حنة	henna	6-CVCCV	نعجة	sheep	6-CVCCV	بصلة	onion
7-CVCCV	بيضة	egg	7-CVCCV	نحلة	bee	7-CVCCV	مقلة	stove	7-CVCCV	لحية	bear	7-CVCCV	سبعة	seven
8-CVCCV	حولي	sheep	8-CVCCV	حفلة	party	8-CVCCV	ربعة	four	8-CVCCV	كفتة	meat	8-CVCCV	ركبه	knee
9-CVCCV	منطة	brish	9-CVCCV	عطلة	vacation	9-CVCCV	قرعة	bottle	9-CVCCV	نملة	ant	9-CVCCV	لوبيا	bean
10-X	كسكس	couscous	10-X	مرايا	mirror	10-X	حريرة	morrocan s	10-X	ستيلو	pencil	10-X	جرانة	frog

Bissylabic lists

Liste 1			Liste 2			liste 3			Liste 4			Liste 5		
1-CCVC	طبيب	doctor	1-CCVC	سحاب	cloud	1-CCVC	لسان	tongue	1-CCVC	ظلام	darkness	1-CCVC	فريز	strawberry
2-CCVC	خريف	spring	2-CCVC	تران	train	2-CCVC	حليب	milk	2-CCVC	فلوس	money	2-CCVC	سنان	sin
3-CCvC	أبيض	white	3-CCvC	كحل	black	3-CCvC	أزرق	blue	3-CCvC	احمر	red	3-CCvC	شعر	hair
4-CCvC	بحر	sea	4-CCvC	رجل	foot	4-CCvC	لحم	meet	4-CCvC	نسر	eagle	4-CCvC	جبل	mountain
5-CVC	دار	house	5-CVC	وجه	face	5-CVC	نيف	nose	5-CVC	خوخ	peaches	5-CVC	باب	door
6-CVC	السور	wall	6-CVC	فول		6-CVC	بيت	room	6-CVC	فيل	elephant	6-CVC	بير	well
7-CVC	حوت	fish	7-CVC	كاس	glass	7-CVC	توت	blueberry	7-CVC	كار	bus	7-CVC	جوج	two
8-CCV	لما	water	8-CCV	دوش	shower	8-CCV	عصا	stake	8-CCV	عمى	ablution	8-CCV	شتا	rain
9-CVCC	أرض	floor	9-CVCC	خبز	bread	9-CVCC	قلب	heart	9-CVCC	عين	eye	9-CVCC	كرش	belly
10-CvCC	خص	lettuce	10-CvCC	بنت	girl	10-CvCC	ولد	boy	10-CvCC	حج	pilgrimage	10-CvCC	عرس	marriage ce

Liste 6			Liste 7			liste8			liste 9			liste10		
1-CCVC	كتاف	shoulder	1-CCVC	حمار	donkey	1-CCVC	نهار	day	1-CCVC	ربيع	spring	1- CCVC	دقيق	flour
2-CCVC	شفار	eyelash	2-CCVC	كتاب	book	2-CCVC	الليل	night	2-CCVC	طريق	road	2- CCVC	زبيب	grappe
3-CCvC	تمر	date	3-CCvC	صبع	finger	3-CCvC	قصر	castle	3-CCvC	سبع	lion	3-CCVC	ضفار	nail
4-CCvC	عسل	honney	4-CCvC	عنب	grappe	4-CCvC	جمل	camel	4-CCvC	اخضر	green	4-CCvC	ضهر	back
5-CVC	روز	rice	5-CVC	سوق	souk	5-CVC	واد	river	5-CVC	موس	knife	5-CCvC	أصفر	yellow
6-CVC	فار	mouse	6-CVC	عود	stick	6-CVC	ديب	wolf	6-CVC	نار	fire	6-CVC	لوز	almond
7-CVC	زيف	skarf	7-CVC	دود	worm	7-CVC	طون	tuna	7-CVC	صوف	wool	7-CVC	قوق	artichoke
8-CCV	الدوا	medicine	8-CCV	كلب	dig	8-CCV	سما	sky	8-CVCC	دب	bear	8-CVC	الزيت	oil
9-CVCC	عود	stick	9-CVCC	عنق	neck	9-CVCC	مش	cat	9-CvCC	عش		9-CCV	جرو	
10-CvCC	قرد		10-CvCC	لفت	radish	10-CvCC	تلج	snow	10-CvCC	عنق	neck	10-CvCC	جد	grand-fathe

2- Lists designed for children in group B (ages 6 and up)

- Monosyllabic lists

Liste 1			Liste 2			liste 3			Liste 4			Liste 5		
2-CCVC	طبيب	doctor	1- CCVC	سحاب	cloud	1- CCVC	لسان	tongue	2-CCVC	ظلام	darkness	2-CCVC	فريز	strawberry
3-CCVC	خريف	spring	3-CCVC	ترام	train	3-CCVC	حليب	milk	3-CCVC	فلوس	money	3-CCVC	سنان	sin
4-CCvC	أبيض	white	4-CCvC	كحل	black	5-CCvC	أزرق	blue	4-CCvC	احمر	red	4-CCvC	شعر	hair
6-CCvC	بحر	sea	5-CCvC	رجل	foot	6-CCvC	لحم	meet	6-CCvC	نسر	eagle	6-CCvC	جبل	mountain
7-CVC	دار	house	6-CCvC	وجه	face	7-CVC	نيف	nose	7-CVC	خوخ	peaches	7-CVC	باب	door
8-CVC	السور	wall	7-CVC	فول		9-CVC	بيت	room	9-CVC	فيل	elephant	9-CVC	بير	well
9-CVC	حوت	fish	9-CVC	كاس	glass	10-CVC	توت	bluebe	10-CVC	كار	bus	10-CVC	جوج	two
11-CCV	لما	water	10-CVC	دوش	shower	11-CCV	عصا	stake	11-CCV	عمى	ablution	11-CCV	شتا	rain
12-CVC(	أرض	floor	12-CVC(	خبز	bread	12-CVC(	قلب	heart	12-CVC(	عين	eye	13-CvC(	كرش	belly
13-CvC(	خص	lettuce	14-CvC(	بنت	girl	14-CvC(	ولد	boy	13-CvC(	حج	pilgrimage	14-CvC(	عرس	marriage ce

Liste 6			Liste 7			liste 8			Liste 9			Liste 10		
1- CCVC	حديد	iron	1- CCVC	إمام	imam	1- CCVC	ريال	cent	1- CCVC	لسان	tongue	1- CCVC	نعاس	sleep
2-CCVC	سلام	salam	2-CCVC	طلاق	divorce	2-CCVC	حليب	milk	2-CCVC	دقيق	flour	2-CCVC	فريز	strawberry
3-CCVC	نهار	daylight	3-CCVC	سلاح	weapon	3-CCVC	سبوع	baptism	3-CCVC	فلوس	money	3-CCVC	خميس	Thursday
4-CCvC	عقل	brain	4-CCvC	وجه	face	4-CCvC	شعر	hair	4-CCvC	شجر	tree	4-CCvC	سبع	lion
5-CCvC	لحم	meet	5-CCvC	أصفر	yellow	5-CCvC	حبل	rope	5-CCvC	قصر	castle	5-CCvC	تمر	dates
6-CCvC	سفر	travel	6-CCvC	رجل	leg	6-CCvC	زرق	blue	6-CCvC	خبز	bread	6-CCvC	عسل	honey
7-CVC	قوق	artichoke	7-CVC	لوز	almonds	7-CVC	فول	broad bean	7-CVC	عين	eye	7-CVC	خوخ	peaches
8-CVC	نيف	nose	8-CVC	طين	mud	8-CVC	دين	religion	8-CVC	ديب	wolf	8-CVC	عيد	eid
9-CVC	واد	river	9-CVC	فار	mouse	9-CVC	عام	year	9-CVC	كول	eat	9-CVC	غار	cave
10-CVC	زيف	scarf	10-CVC	رعد	thorns	10-CVC	دود	worms	10-CVC	موس	knife	10-CVC	كار	bus
11-CCV	برا	needle	11-CCV	برّا	outside	11-CCV	شوا	barbecue	11-CCV	طفا	turn off	11-CCV	شتا	rain
12-CvCC	علف	hay	12-CvCC	قلب	heart	12-CvCC	طير	bird	12-CvCC	ورد	rose	12-CvCC	عود	horse
13-CvCC	دم	blood	13-CvCC	جد	grandfather	13-CvCC	سد	he closed	13-CvCC	خط	line	13-CvCC	شم	snif
14-CvCC	قرد	monkey	14-CvCC	بنت	girl	14-CvCC	ولد	boy	14-CvCC	كرش	belly	14-CvCC	جرح	hurt

Bissylabic lists

Liste 1			liste 2			liste 3			liste 4			Liste 5		
1- CVCV	**بولة**		1- CVCV	قاضي	judge	1- CVCV	صورة	photo	1- CVCV	ريحة	parfum	1- CVCV	موجة	wave
2-CVCVC	أتاي	tea	2-CVCVC	طاجين	tajine	2-CVCVC	**دانون**	yogurt	2-CVCVC	بوليس	police	2-CVCVC	فقير	poor
3-CvCCVC	درهم	dirham	3-CvCCVC	قرآن	quran	3-CvCCVC	**سروال**	pant	3-CvCCVC	شعبان	shaaban	3-CvCCVC	شرجم	window
4-CvCCVC	نعناع	mint	4-CvCCVC	تفاح	apple	4-CvCCVC	أرقام	numbers	4-CvCCVC	كاوكاو	cacao	4-CvCCVC	بغرير	baghrir/morc
5-CvCCVC	صباط	shoe	5-CvCCVC	**فرحان**	happy	5-CvCCVC	كركاع	walnut	5-CvCCVC	طبسيل	plate	5-CvCCVC	**دلاح**	watermelon
6-CVCCV	كرسي	chair	6-CVCCV	خضرة	vegetable	6-CVCCV	مكة	mecca	6-CVCCV	طاكسي	taxi	6-CVCCV	شبكة	basket
7-CVCCV	زبدة	butter	7-CVCCV	**جردة**	garden	7-CVCCV	صحة	health	7-CVCCV	حلوة	cookies	7-CVCCV	**طبلة**	table
8-CVCCV	صخرة	rock	8-CVCCV	خمسة	five	8-CVCCV	وردة	rose	8-CVCCV	**بطة**		8-CVCCV	ضحكة	smile
9-CVCCV	**بقرة**	cow	9-CVCCV	قهوة	coffee	9-CVCCV	رملة	sand	9-CVCCV	جردة	garden	9-CVCCV	خيمة	tent
10-X	مدينة	city	10-X	**دجاجة**	chicken	10-X	سبيطار	hospital	10-X	بطاطا	potato	10-X	**زوينة**	beautiful

Liste 6			liste7			liste8			liste 9			Liste 10		
1- CVCV	كورة	ball	1- CVCV	كيكة	cake	1- CVCV	بيمو	biscuit	1- CVCV	توما	garlic	1- CVCV	بولو	icecream
2-CVCVC	إمام	imam	2-CVCVC	عصير	juice	2-CVCVC	صالون	living room	2-CVCVC	**ساروت**	key	2-CVCVC	**بانان**	banana
3-CvCCVC	فران	oven	3-CvCCVC	شكلاط	chocolate	3-CvCCVC	وذنين	ears	3-CvCCVC	بزاف	a llot	3-CvCCVC	**شبعان**	
4-CvCCVC	أستاذ	professor	4-CvCCVC	**طربوش**		4-CvCCVC	مشماش	apricot	4-CvCCVC	تسعود	nine	4-CvCCVC	**سلوم**	ladder
5-CvCCVC	سكار	sugar	5-CvCCVC	نجار	carpenter	5-CvCCVC	منشار	saw	5-CvCCVC	**براد**	tea-pot	5-CvCCVC	**صياد**	hunter
6-CVCCV	شجرة	tree	6-CVCCV	جمعة	Friday	6-CVCCV	حنة	henna	6-CVCCV	**نعجة**	sheep	6-CVCCV	**بصلة**	onion
7-CVCCV	بيضة	egg	7-CVCCV	حجرة	rock	7-CVCCV	هضرة	talk	7-CVCCV	لحية	bear	7-CVCCV	**سبعة**	seven
8-CVCCV	راديو	radio	8-CVCCV	حفلة	party	8-CVCCV	ربعة	four	8-CVCCV	**كفتة**	meat	8-CVCCV	**دمعة**	tear
9-CVCCV	خدمة	job	9-CVCCV	عطلة	vacation	9-CVCCV	**قرعة**	bottle	9-CVCCV	زنقة	street	9-CVCCV	**لوبيا**	bean
10-X	كسكس	couscous	10-X	مرايا	mirror	10-X	**حريرة**	morrcan so	10-X	**ستيلو**	pencil	10-X	**جرانة**	frog

Fig. 3. Word lists

The reinforcement is the playful maneuver proposed to the child to encourage him to renew his answers. We used 3 types of conditioning: Verbal reward, PeeP Show, Embedding game.

3. RESULTS

We designed a total of 40 lists distributed as follows: 20 Lists for children aged 3 to 5 years: 10 monosyllabic lists of 10 words and 10 bissylabic lists of 10 words, and 20 lists for children aged 6 years and older: 10 monosyllabic lists of 14 words and 10 bissylabic lists of 10 words, and we included in our study 84 normal hearing children under 12 years of age.

3.1 Quantitative Results

Age: The average age was 6.4 years with extremes ranging from 3 to 12 years. The

population was divided into 2 age groups: Group A: age between 3 and 5 years (n=40) Group B: age between 6 and 12 years (n=44) The average age in group A was 4.2 years with extremes (5-3 years) and in group B was 8.3 years with extremes (12-6).

Schooling, 9.52% of the children were not in school, all were under 5 years old.

3.2 Audiometric Validation

On average, the time of realization of the tonal and vocal audiometric tests was 40 minutes with extremes ranging from 30 minutes to 60 minutes.

Group A: Pure tone audiometry was performed with headphones in 45% of the children (n=18) with a hearing threshold was between 10 and 20dBHL in 100%, and in free field in 55% of the children (n=22) the hearing threshold was between 15 and 30dB in 100% of the children, the S-shaped elongated speech audiometry curve was present in 100% of the cases.

Group B: Pure tone audiometry was performed with headphones in 100% of the children in group B (n=44), the hearing threshold was above 20dBHL in 100% of the children (n=44), the elongated S-shaped speech audiometry curve was present in 100% of the cases at the level of both ears combined.

3.3 Qualitative Results

10 lists of 10 monosyllabic words and 10 lists of 10 bisyllabic words were tested for group A. The identification difficulties were due to the same reasons: the word was not known to the child and despite the pretest the child could not repeat it, the image was not evocative enough and the child hesitated or made mistakes.

All words in the mono- and bisyllabic lists studied for Group B children were recognized and repeated at conversational thresholds.

4. DISCUSSION

Speech lists must meet a number of rules that differ according to each country's language. In the Arab Maghreb countries, HadiMessouak was the first to produce and publish phonetic material in Maghrebian Arabic for Tunisians, Algerians and Moroccans in 1956 [4]. In French-speaking countries, the most widely used lists for children are those of Lafon, but those of Fournier represent the basis of intelligibility tests [5]. In our study, we used the Moroccan monosyllabic and dissyllabic lists for adults, which we adapted to the child, taking into account all the stages of his oral, cognitive and motor development.

It is well know that children under the age of 5 can have a lack of vocabulary, so picture identification is a widely used technique for describing children's known vocabulary [6]. For an image to be easily recognized by the child, it must meet two criteria: representability and simplicity of identification.

We recorded the Voice material in accordance with ISO 8253-3 [7], it allows to have reliable and reproducible answers.

For a child to understand a word, several parameters must be involved: psychomotor development, hearing, cognitive and cultural aspects, linguistic aspects, intelligence, and mental reserve strength.

Development is often divided into specific domains, such as gross motor, fine motor, language, cognitive and developmental [8]. For this study, the children had a normal psychomotor development. And Behavioral audiometry allows to study the entire auditory field, especially the 250, 500 and 1000 Hz frequencies that are not always explored by conventional objective audiometry techniques, it guides the indication of objective tests, but It also provides information on the psychological behavior and communication level of the child [9].

In our study, the 3 means of conditioning were the Peep Show, the embedding game and the verbal reward.

The helmet is often poorly accepted by small children. We can then resort to the study of the threshold by air conduction in free field. This corresponds to the air conduction threshold of the better ear [9].

In our study, 55% of the children aged 3 to 5 years were tested in the free field compared to 45% in the headphones. Whereas 100% of the children aged 6 years and older adhered without difficulty to the headphones.

Voice audiometry: Voice audiometry is a complement to behavioral audiometry to verify the concordance of the results, and this from the age of 6 months. This examination is therefore essential to perform.

This audiometry involves understanding the message that induces a response, which varies according to the age of the child. The voice constitutes for the child a much more natural stimulus than pure sounds. It is recognized as a significant message depending on linguistic acquisitions [9].

That's why the adaptation of speech audiometry lists in children is necessary, especially in countries where the dialect differs from the official language, as is the case in China [10]. In the Maghreb, this study is the first one to be performed in children.

5. CONCLUSION

This work is an extension of a first study carried out by the ENT team of the University Hospital of Casablanca, which concerned the design and validation of Moroccan voice lists for adults.

Behavioral and vocal audiometry of small children requires a trained, patient, and attentive examiner.

At the end of this study, 20 illustrated voice lists for Moroccan children from 3 years of age and 20 recorded voice lists for Moroccan children from 6 years of age were validated in normal hearing children.

This is a first step before the validation of these lists in deaf children and by extension in cochlear implanted children.

CONSENT

Parental consent was signed prior to conducting the study.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Humphriss R, Hall A, et al. Does cochlear implantation improve speech recognition in children with auditory neuropathy spectrum disorder? A systematic review. International Journal of Audiology. 2013;52(7):442-54.
2. McCreery RW, et al. Individual differences in language and working memory affect children's speech recognition in noise. International journal of audiology. 2017;56(5):306-15.
3. Gravel JS, Fausel N, Liskow C, Chobot J. Children's speech recognition in noise using omni-directional and dual-microphone hearing aid technology. Ear and Hearing. 1999;20(1):1-1.
4. Practical guide to speech audiometry in Moroccan Arabic [Internet]. dokumen.tips. Available:https://dokumen.tips/health-medicine/guide-pratique-sur-laudiometrie-vocale-en-arabe-marocain.html Access on 2022 Nov 16
5. Rembaud F, Fontan L, Füllgrabe C. Speech audiometry in France: State of the art [Speech audiometry in France: Current clinical practices]. Cah Audit. 2017;30: 22-5.
6. Abou Haidar L, Blond MH, Chautemps D, Ployet MJ, Lescanne E. "Audio 4": A simple and rapid voice test for the detection of moderate hearing loss in children at the age of four. Arch Pediatrics. 2005;12(3):264-72.
7. Adult audiometry guide. French society of audiology.
8. Child Development - Pediatrics [Internet]. MSD Manual Professional Edition. Available:https://www.msdmanuals.com/en/professional/diatrics/growth-and-development/child-development Access on 2022 Nov 16
9. Legent F. Practical audiology, audiometry [Internet]. Paris: Elsevier, Masson; 2011. Available:http://site.ebrary.com/id/10538560 Access on 2017 Jul 22
10. Li Y, et al. Validation of listequivalency for mandarin speech materials to use with cochlear implant listeners. Int J Audiol. 2017;56(sup2):S31-S40. DOI: 10.1080/14992027.2016.1204564. Epub 2016 Jul 14 PMID: 27414242; PMCID: PMC5237407

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