Original articles

Validation of the neurofunctional evaluation protocol for Alternative and Augmentative Communication

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ABSTRACT

Objective: to validate the neurofunctional evaluation for Alternative and Augmented Communication protocol.

Methods: the study was carried out in four steps: instrument construction, literature review, clinical validation and evaluation of the protocol by field experts, through an interactive questionnaire which was repeatedly applied, until the last set of responses was regarded as satisfactory. In addition, clinical evaluations were performed by applying the protocol in children and adolescents with motor impairment in a clinical trial.

Results: statistical analysis of the protocol application in the therapeutic setting showed the Kappa indices for each observer with an overall mean of 0.436 (moderate agreement), besides the agreement among experts in content evaluation.

Conclusion: agreement between the evaluators, specialists and the protocol clinical application results allowed choosing and implementing an alternative communication resource appropriate to the neuromuscular characteristics of the patient, providing a low cost access, as well as the quick identification of the motor skills that enabled the speech-language therapy.

Keywords: Communication; Disabled Persons; Validation Studies

INTRODUCTION

This research articulates areas of Speech, Language and Hearing Sciences that study the Augmentative and Alternative Communication (AAC), Motor Deficiency and the neuromotor aspects that influence access to the AAC. In the process of implementation of the AAC, questions arise regarding access to high and low technology instruments for subjects with cerebral palsy and other motor deficiencies. It is understood that the development of language will be more effective once the issues of accessibility to communication are met.

The AAC is based on the Assistive Technology (AT) area, which is defined as an area of knowledge with an interdisciplinary feature, involving resources, strategies, practices and services, aiming to promote functionality, relating it to the participation of people with disabilities in the promotion of autonomy, independence, quality of life and inclusion[1,2].

Augmentative and Alternative Communication is a subarea of the Assistive Technology and, according to Gonçalves[3], it arose in clinical practice, from the need to think / find forms of communication for people who could not communicate through speech. According to Bersch[4], AAC interferes in interpersonal relationship and social insertion, directly assisting in the process of communication and interaction.

The alternative communication resources are diversified, inherent in the specifics of each user, being divided according to complexity and cost, classified in high and low technology. Low-tech features involve low-cost materials with a greater opportunity for access and easy to use, such as adapted books; adapted computer keyboards; and planks formed by pictographic symbols, such as PCS, a system with a limitation of meanings. High-tech instruments, on the other hand, involve high-cost materials such as triggers, vocalizers and software that enable total independence in the communication of their users[5].

The AAC provides communicative interactions of individuals without orality, being an important tool in the process of language constitution and school interaction, essential for the learning process[6,7]. The use of language is the most important condition for the development of the child's higher psychological structures. The internalization of historically determined and culturally organized contents takes place through language, first on a social, then in an individual level[8].

It is emphasized that the AAC is not a factor that inhibits speech, since it structures the linguistic functioning of the individual. The development of language, from the socio-historical interactionist perspective, is deprived of determining mechanisms during acquisition. Language is conceived as an instrument responsible for the organization of thought and the social emancipation of the subject, becoming active and a co-author of his / her own development[8]. According to Leontiev, 1988, p. 82:

[…] the child is not limited, in fact, to changing places in the system of social relations. He / she also becomes aware of these relationships and interprets them. The development of their consciousness finds expression in a change in the motivation of their activity; old motives lose their stimulating force, and new ones are born, leading to a reinterpretation of their earlier actions[9].

The AAC acts in this context as a tool for learning and, thus, guarantees the importance of its implementation in the school context.

The scales developed until then seek to evaluate functions or skills and not the implicit motor performance in the function. The use of ICF (International Classification of Functioning, Disability and Health) by professionals involved in the rehabilitation process increases the quality and the individuality of patient data, since two people with the same disease may present different functional manifestations, and two people with equivalent functional capacity do not necessarily present the same health condition[10].

There are protocols that evaluate communicative functions with a traditional focus on body structure and function (evaluating speech components, language and hearing problems) in order to classify a person's ability to communicate in real life: Gross Motor Function Classification System (GMFCS), Manual Ability Classification System (MACS) and Communication Function Classification System[11].

These protocols still do not allow the evaluation focusing on the motor aspects for the initial moment of the implementation process of the Alternative Communication, thus, it is still necessary to validate a specific protocol for the neuromotor aspects of people with motor disabilities. Since 88% of the children diagnosed with cerebral palsy present communicative alterations[12], the use of CAA is strongly justified.

The International Classification of Functioning, Disability and Health (IFC) is an internationally used instrument, which considers the subject in his / her singularity, even if it belongs to a similar diagnostic group. The IFC has two divisions, each part consisting

of two components: the first part refers to Functionality and Disability, which have as components the Body, in which there are two classifications (functions of body systems and structures) and Activities and Participation; the second part refers to the Contextual Factors structured by Environmental Factors and Personal Factors[13].

The alternative communication is used in this work as a resource to reach the linguistic construction, recognizing the system as one of the alternative forms in the interaction of individuals with neuromotor deficit and taking the language as an interactional function pertinent to the exchanges of experiences between the subjects in structuring their interpersonal relationships. Establishing itself on the work bias in networks with subject, therapy and family, we sought to discuss the aspects involved in this process, using the IFC as a subsidy for construction and application of the protocol of neurofunctional evaluation. In this context, the objective of this study was to validate a neurofunctional assessment protocol for the AAC that would measure muscle tone and functioning in children and adolescents with motor deficits entitled *Protocol of Neurofunctional Evaluation for Augmentative and Alternative Communication.*

METHODS

This study has as an ethical contribution the recommended precepts of the Ethics and Research Committee (CEP) involving human beings of the University Hospital of Aracaju of the Federal University of Sergipe, receiving the approval number of 15822613.7.0000.5546 12/28/2013.

The work has a quantitative-qualitative nature and was developed in three phases. The first phase concerns the construction of the instrument that was already in progress in a previous project. Four experts focused the second phase on content review and evaluation. For data collection, a group of experts, preserving the anonymity of individual responses, used the Delphi method from an interactive questionnaire that circulated repeatedly. Necessary documents were prepared for this process, such as the invitation letter, the presentation of the protocol and a data collection instrument containing a questionnaire that was sent to the evaluators.

The third phase included a series of clinical assessments in five patients with the objective of investigating the possible triggers for communication, from the use of the Neurofunctional Assessment Protocol for Choice of Alternative Communication Resource (APPENDIX A). The Protocol is divided into articulations, voluntary and involuntary movements and reflexes, among other parameters that influence the choice of triggers for the AAC.

The evaluation guided by the protocol was divided into three moments: moment 1, in which the evaluation is performed through observations during the attendance using low technology; moment 2, with an evaluation through induction of activities, in order to perform the necessary movements for the analysis - with high technology resources; and moment 3, with the specific evaluation of the movements. The three moments are applied in a hierarchical way, that is, moment 2 is performed if the data obtained at moment 1 were not enough for the analysis, occurring the same at moment 3.

The evaluation data were collected according to the qualifier: Function and Structure, being: F = Force, R = Resistance, M = Mobility, S = Stability, C = Control, Rig = Rigidity and Sp = Spasm; ranging from 0 to 4, being 0 - no deficiency, 1 - mild deficiency, 2 - moderate deficiency, 3 - severe deficiency and 4 - complete deficiency.

The selection of the subjects for the research met the eligibility criteria previously established: to be subjects with motor deficiency between 3 and 20 years old, to have preserved comprehension and presence of language alterations. The patients were selected at the Specialized Rehabilitation Center (SRC). The selection was made based on the medical diagnosis, motor profile and Speech, Language and Hearing Sciences assessment. Participants were included after signing the Free and Informed Consent Term (TCLE).

The last census carried out by the Brazilian Institute of Geography and Statistics (IBGE) for 2010[14], made available by the Health Care Network Coordination (CERAS), was used for the sample calculation of the subjects participating in the research, which indicated the total number of 10470 people with severe motor deficiency in the city of Aracaju. The sample size of 5 (five) individuals was delimited, with an acceptable error of 10% and a 90% confidence level.

Three sessions were recommended to carry out the evaluation of the candidates for the use of the alternative communication resource and application of the protocol in the clinical setting.

The neurofunctional evaluation protocol was answered in the therapeutic setting by two evaluators (research students) during the 1st, 2nd and 3rd moments to analyze the levels of

inter- and intra-evaluator concordance, with the evaluators performing the analysis individually.

Statistical Analysis

The data of the evaluation in the therapeutic space using the protocol of execution of neurofunctional evaluation to choose an alternative resource of communication were placed in a data sheet of the program Statistical Package for Social Sciences SPSS, version 16.0, with a significance level of 5% ($p > 0.05$). After the data were obtained, Kappa and Shapiro-Wilks tests were performed to verify the normality. The results obtained and classified as parametric analysis were expressed descriptively.

RESULTS

The construction of the protocol was based on the selection of domains of the CIF that better guided the choice of the resources of Augmentative and Alternative Communication. The chapters were selected using the Neurofunctional Assessment targeting criteria, that is, the chapters that best guided the moment of evaluation, containing relevant items for a precise definition of the resources to be used by each subject.

The selection of CIF items specifically followed two chapters: the 7th - "Funções Neuromusculoesqueléticas e funções relacionadas com o movimento" (Neuromusculoskeletal functions and functions related to movement) and the 2nd - "Funções sensoriais e dor" (Sensory functions and pain), with the articulation of the functions related to the eye in the latter.

From the selected items, five guiding components were chosen for evaluation: F = Force, R = Resistance, M = Mobility, S = Stability, C = Control, Rig = Rigidity and Sp = Spasm. A scale was also adopted - Qualifiers - from 0 to 4, which represented the degree of Function and Structure; these qualifiers were divided into: 0 - No deficiency, 1 - Mild deficiency, 2 - Moderate deficiency, 3 - Severe deficiency, 4 - Complete deficiency.

The protocol had the objective to allow a greater visualization of the data obtained in the neurofunctional evaluation, by joining the items of the CIF, the selected components and the qualified ones, reverberating in specific and concrete data with an evaluation criteria in common for all evaluated subjects.

The first version of the protocol was sent to specialists in the field for possible adjustments. At the end of this adjustment process, a new document, valid in its content and adapted according to the experts' suggestions appeared. The questionnaire for data collection was composed of three parts: the first one refers to the presentation of the research objective and guides to the specialists regarding the filling of the instrument. The second consists in the characterization of specialists with data on sex, age, occupation, place of work, municipality of work, duration of school formation and questions related to professional experience in teaching, research and use of Alternative Communication. The third is the Instrument for the evaluation of the protocol.

In the first round, the specialists received the presentation of the protocol and the instrument of data collection containing a questionnaire and were asked to respond individually with quantitative answers supported by justifications and qualitative information. With each new round, the questions were repeated and the participants re-evaluated their responses from the reformulated protocol according to the answers of the experts from the previous round. New forecasts were requested with justifications, and this process was repeated in the successive rounds of the questionnaire, until the response of the last round was considered with a satisfactory level of agreement. Regarding the interactive questionnaire that circulated among specialists in the field, although it was sent to 33 specialists, only 11 responded to the invitation letter, 7 signed the TCLE, 4 participated in the first round and 3 in the second.

As for titration, half of the experts were doctors and masters and all had specialization in AAC or language (Figure 1). All the experts had experience in the area of AAC, and their activities varied between teaching, assistance and research.

	Occupation	Time of operation	Graduation Degree
Specialist 1	Professor	38 years old	Doctorate degree
Specialist 2	Clinician	30 years old	Specialization
Specialist 3	Professor and Clinician	30 years old	Doctorate degree

Figure 1. Description of the experts who participated in content evaluation

The experts answered the following questions in the two rounds. In the second round, the agreement between the evaluators was perceived and possible application bias was clarified, as presented in Table 1.

Table 1. Descriptive analysis of expert content evaluation

	Participants	Round 1	Round 2
Implementation protocol for neurofunctional evaluation - Functional Evaluation for Alternative Communication in Motor Deficiency (ACADM) - representing the presented content	Spe 1	I Disagree	I agree
	Spe 2	Do not agree or disagree	I agree
	Spe 3	I Disagree	I agree
Does it clearly define the definition of neurofunctional assessment for the implementation of Alternative Communication?	Spe 1	I disagree	I agree
	Spe 2	Do not agree or disagree	Strongly Agree
	Spe 3	Do not agree or disagree	Do not agree or disagree
Is the purpose described consistent with the content of the protocol?	Spe 1	I disagree	Strongly agree
	Spe 2	Strongly agree	Strongly Agree
	Spe 3	I agree	Do not agree or disagree
Is the information contained in this protocol adequate for the target audience of this protocol?	Spe 1	I agree	Strongly agree
	Spe 2	Do not agree or disagree	Do not agree or disagree
	Spe 3	I agree	Do not agree or disagree
Do the general instructions reflect the most relevant information in the protocol and tell you the step-by-step how to use it?	Spe 1	I disagree	Strongly agree
	Spe 2	I agree	I agree
	Spe 3	I agree	Do not agree or disagree
Can the demonstrated results be achieved with the protocol?	Spe 1	I disagree	Strongly agree
	Spe 2	Do not agree or disagree	I agree
	Spe 3	Do not agree or disagree	I agree
Does the protocol evaluate all the important variables for the motor aspects that imply the implementation of the CAA?	Spe 1	I agree	Do not agree or disagree
	Spe 2	I agree	I agree
	Spe 3	I disagree	Do not agree or disagree

*Spe = Specialist

The rounds were finalized with the consensus among the specialists of the final version of the Neurofunctional Assessment Protocol for Choice of Alternative Communication Resource (APPENDIX A). The protocol contains the following variables to be analyzed:

- Function of joints and bones (mobility of the cervical joints, mobility of the shoulder joint, mobility of the wrist joints, mobility of the joints of the hands, mobility of the joints of the feet, mobility of the hip joints, control of voluntary cervical movements, control of voluntary movement of the hand, control of the voluntary movement of the arm, control of the voluntary movement of the lower limbs, control of the right side movement, mobility of the bones of the shoulder, mobility of the bones of the pelvis, mobility of the carpal bones, mobility of the shoulder blade bones, mobility of the tarsal bones and general control of the joints);

- Muscle functions (functions related to muscle strength of the head, functions related to muscular strength of the upper limbs, functions related to muscular strength of the lower limbs, functions related to muscular strength of the hands, functions related to muscular strength of the feet and functions related to muscle strength);

- Functions related to movement (functions related to postural reflexes, functions related to stretching tonic reflexes, hyperreflexia, hyporreflexia, functions related to involuntary movements, stereotypies and perseveration);

- Vision and related functions (acuity, field, binocular, monocular, eyelid and direction).

In addition to these variables, the following items were included as suggested by experts in the area:

Functional Conclusion (low-tech features: board, looking board, table, panels, book, binder, folder, album; high tech features: mouse, eye tracker, keyboard hive, vocalizer, computer, tablet and pressure trigger);

Possible creative movements for triggers (blinking, aiming, cervical movement, shoulder movement, blowing, jaw movement, hand movement, wrist movement, arm movement, finger movement, leg movement, foot movement, toe movement and pointing).

Regarding the neurofunctional evaluations of the therapeutic setting, 7 subjects were evaluated, among the children / adolescents who started the project. Of those, 5 completed the neurofunctional evaluation using the protocol, the others were turned off because they did not fit the intended profile. Another part of the selected subjects did not participate in the study due to non-attendance or difficulty in access.

Neurofunctional evaluation of the subjects with the qualifiers chosen by the evaluators (Table 2):

Table 2. Analysis of the clinical findings of the protocol

	Patient 1		Patient 2		Patient 3		Patient 4		Patient 5	
Functions of Joints and Bones	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**
Mobility of cervical Joints	2	3	1	0	4	4	4	4	1	1
Stability of cervical joints	3	2	3	2	4	4	4	4	3	4
Control of Cervical Joints	2	3	3	1	4	4	4	4	3	3
Mobility of the shoulder joint	3	3	3	3	4	4	3	4	1	2
Stability of shoulder joints	3	2	3	4	4	4	4	4	2	3
Control of shoulder joints	3	2	3	3	4	4	3	4	3	3
Mobility of wrist joints	2	2	3	2	4	4	4	4	0	0
Stability of wrist joints	2	3	3	3	4	4	4	4	2	2
Control of wrist Joints	2	2	3	2	4	4	4	4	3	3
Mobility of joints of the hands	2	3	3	1	4	4	4	4	0	0
Stability of joints of the hands	2	3	3	2	4	4	4	4	2	2
Control of joints of the hand	2	3	3	3	4	4	4	4	3	2
Mobility of the joints of the feet	3	3	0	0	4	4	4	4	3	2
Stability of the joints of the feet	3	3	1	1	4	4	4	4	3	3
Control of the joints of the feet	3	3	1	1	4	4	4	4	3	2
Mobility of hip joints	3	4	3	4	4	4	4	4	3	4
Stability of hip joints	3	3	3	4	4	4	4	4	3	4
Control of hip joints	3	3	3	4	4	4	4	4	3	4
Control of voluntary cervical movement – only	2	4	3	2	3	4	4	4	2	3
Control of voluntary cervical movement – multiple	1	4	3	2	3	4	4	4	3	4
Control of voluntary cervical movement – mobility	2	4	3	0	3	4	4	4	2	1
Control of voluntary cervical movement – stability	2	3	3	2	3	4	4	4	3	4
Control of voluntary cervical movement – control	2	3	3	1	3	4	4	4	3	3
Control of voluntary hand movement – only	2	2	3	2	4	4	4	4	2	2
Control of voluntary hand movement – multiple	1	2	3	3	4	4	4	4	3	3
Control of voluntary hand movement – mobility	2	2	3	2	4	3	4	4	1	2
Control of voluntary hand movement – stability	2	3	3	2	4	4	4	4	2	2
Control of voluntary hand movement – control	2	2	3	3	4	4	4	4	2	1
Control of voluntary arm movement – only	3	3	3	3	4	4	4	4	1	2
Control of voluntary arm movement – multiple	1	2	3	3	4	4	4	4	2	3
Control of voluntary arm movement – mobility	2	3	3	3	4	4	4	4	1	2
Control of voluntary arm movement – stability	2	3	3	3	4	4	4	4	2	2
Control of voluntary arm movement – control	2	3	3	3	4	4	4	4	2	1
Control of voluntary movement of the lower limbs – only	2	4	1	1	4	4	4	4	2	2
Control of voluntary movement of the lower limbs – multiple	1	4	1	1	4	4	4	4	2	1
Control of voluntary movement of the lower limbs – mobility	2	3	1	0	4	4	4	4	2	2
Control of voluntary movement of the lower limbs – stability	2	3	1	1	4	4	4	4	3	3
Control of voluntary movement of the lower limbs – control	2	3	0	1	4	4	4	4	2	3
Control of the right side movement – only	2	3	1	2	4	4	4	4	1	1
Control of the right side movement – multiple	2	3	1	2	4	4	4	4	3	3
Control of the right side movement – mobility	2	2	1	2	4	4	4	4	1	2
Control of the right side movement – stability	2	3	1	3	4	4	4	4	2	3
Control of the right side movement – control	2	3	1	2	4	4	4	4	2	2
Mobility of bones of the shoulder blade	2	2	3	3	4	4	4	4	2	2
Stability of bones of the shoulder blade	2	4	3	4	4	4	4	4	2	3
Control of bones of the shoulder blade	2	4	3	3	4	4	4	4	2	3
Mobility of pelvic bones	4	4	3	3	4	4	4	4	3	3
Stability of pelvic bones	4	4	3	3	4	4	4	4	3	4
Control of pelvic bones	4	4	3	3	4	4	4	4	3	4
Mobility of carpal bones	4	3	2	3	4	4	3	4	0	0
Stability of carpal bones	4	4	3	3	4	4	3	4	0	0
Control of carpal bones	4	4	3	3	4	4	3	4	0	0

	Patient 1		Patient 2		Patient 3		Patient 4		Patient 5	
Functions of Joints and Bones	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**
Mobility of tarsal bones	4	3	0	0	4	4	3	4	2	2
Stability of tarsal bones	4	4	0	0	4	4	4	4	2	3
Control of tarsal bones	4	4	0	0	4	4	4	4	2	2
General joint control – mobility	3	3	2	2	4	4	3	4	2	2
General joint control – stability	3	3	2	2	4	4	4	4	3	3
Muscle Functions	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**
Functions related to muscle strength of the head – Isotonic	0	3	3	2	4	4	0	0	3	3
Functions related to muscle strength of the head – Hypotonic	0	0	3	2	4	4	1	1	3	3
Functions related to muscle strength of the head – Hypertonia	3	4	3	0	4	4	0	0	0	0
Functions related to muscle strength of the head – Isolated	0	2	3	3	4	4	1	1	2	2
Functions related to muscle strength of the head – group	0	2	3	3	4	4	1	3	3	3
Functions related to muscle strength of the head – force	3	2	3	3	4	4	3	3	3	3
Functions related to muscle strength of the head – resistance	3	4	3	3	4	4	3	3	3	3
Functions related to muscular strength of the upper limbs – isolated	2	3	1	3	4	4	4	4	1	2
Functions related to muscular strength of the upper limbs – group	2	2	1	3	4	4	4	4	2	2
Functions related to muscular strength of the upper limbs – force	2	1	3	3	4	4	4	4	1	1
Functions related to muscular strength of the upper limbs – resistance	2	3	3	3	4	4	4	4	2	2
Functions related to muscular strength of the lower limbs – isolated	3	4	0	0	4	4	4	4	2	3
Functions related to muscular strength of the lower limbs – group	3	4	0	0	4	4	4	4	3	3
Functions related to muscular strength of the lower limbs – force	3	4	0	0	4	4	4	4	3	3
Functions related to muscular strength of the lower limbs – resistance	3	4	0	0	4	4	4	4	3	4
Functions related to muscular strength of the hands – isolated	4	2	3	1	4	4	4	4	1	1
Functions related to muscular strength of the hands – group	4	2	3	1	4	4	4	4	1	1
Functions related to muscular strength of the hands – force	2	1	3	0	4	4	4	4	1	1
Functions related to muscular strength of the hands – rigidity	2	2	3	3	4	4	4	4	1	1
Functions related to muscular strength of the feet – isolated	2	4	0	0	4	4	3	4	2	3
Functions related to muscular strength of the feet – group	3	4	0	0	4	4	4	4	3	3
Functions related to muscular strength of the feet – force	3	4	0	0	4	4	4	4	2	3
Functions related to muscular strength of the feet – resistance	2	4	0	1	4	4	3	4	2	3
Functions related to muscle strength – right side	2	1	3	3	4	4	3	4	2	2
Functions related to muscle strength – left side	3	2	2	3	4	4	3	4	3	3
Functions related to muscle strength – inferior half	2	2	1	2	4	4	3	4	3	3
Functions related to muscle strength – all the limbs	3	2	3	3	4	4	3	4	2	3
Functions related to movement	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**
Functions related to reflexes - postural reflexes	4	3	3	4	4	4	3	3	4	4
functions related to stretching tonic reflexes	3	3	3	3	4	4	2	3	1	1
Hyperreflexia	4	4	3	3	4	4	2	2	1	1
Hyporreflexia	0	0	3	0	4	4	0	0	0	0
Functions related to involuntary movements	4	3	3	2	4	4	2	4	2	1
Stereotypies and perseveration	0	4	1	0	4	4	0	0	0	0
Vision and related functions	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**	**Th1**	**Th2**
Acuity	0	0	0	0	1	0	0	0	0	0
Field	0	0	0	0	1	1	0	0	2	2
Binocular	0	0	0	0	1	1	0	0	0	0
Monocular	0	0	0	0	1	1	0	0	0	0
Eyelid	0	0	0	0	2	1	3	3	1	2
Direction	0	0	0	0	3	3	0	0	2	1

Subtitle: Therapist evaluation: Kappa indexes for each observer with a general average of 0.436 (moderate agreement). * Th = Therapist

The statistical analysis of the data collected in the neurofunctional evaluation in the clinical space results in Kappa indexes for each observer with a general mean of 0.436 (moderate agreement). Therefore, the protocol is reproducible. Since there was an agreement among the evaluators, the items of the protocol were kept. The data presented normal distribution according to the Shapiro Wilk test.

Descriptive analysis with the profile characterization of the subjects and alternative resource chosen:

Patient 1: 14 years old, male, with mild motor alteration, low-tech alternative resource - board with pictographic symbols.

Patient 2: 13 years old, male, mild motor alteration, low-tech alternative resource - board with pictographic symbols.

Patient 3: 10 years old, male, severe motor alteration, high-tech alternative resource - infrared light beam placed on the spectacle frame (without lenses) triggered by blinking eyes.

Patient 4: 10 years old, male, diagnosed with Tay Sachs syndrome, severe motor impairment, high-tech alternative - accelerometer sensor triggered with eyebrow movement.

Patient 5: 5 years old, female, severe motor alteration, high-tech alternative resource - pressure trigger triggered by hand-closing movement.

DISCUSSION

One of the greatest challenges was to obtain the sample size of the subjects and the unfamiliarity of professionals with the competence established by the research, such as not mastering the subject, not knowing the methodology used, among others[15].

The fact that the protocol has been evaluated by experts with academic qualifications, according to Galdeana and Rossi[16], increases the credibility of the data. The performance of professionals in both the public and private spheres favors the analysis of the indicators from different point of views, considerably enriching the validation process by the content validation strategy[15].

The choice of triggers as an alternative communication resource opens a range of possibilities for these subjects. Children with lack of speech, but users of alternative communication systems are able to understand and make themselves understood in the world of language. It can be achieved through looks, gestures, facial expressions and body posture, allowing their interaction with others and a greater insertion in society[17-19].

In the literature, it is found that children, youngsters and adults with oral and written communication difficulties need the help of supplementary and / or alternative communication to broaden communicative exchanges, acquire new communicative skills and thus broaden the range of interlocutors in other social contexts[20-25].

The alternative resource acts as an instrument of communication and interaction with the other, providing subjects with a better quality of life, as shown by an article published by the group, with an initial version of the protocol[26].

CONCLUSION

It is believed that the protocol developed will have positive implications for clinical practice, since the neurofunctional evaluation following the developed protocol allowed the choice and implementation of an alternative communication resource more appropriate to the patient's neuromuscular characteristics.

The application of this evaluation protocol in the clinical routine would allow, in a quick and low cost way, to identify which components of the motor functions or abilities are to be developed or to control and thus to implement the therapeutic action - being able to communicate represents improvement in the quality of life of individuals with serious, motor and linguistic limitations. It would bring dominance in areas such as acquisition of biological quantities, data processing, and creation of interfaces for interaction and integration of systems. This set of knowledge may be the basis for extending the current project or generating new projects. The study of neurofunctionality in subjects with motor impairment can define strategies of use for the CAA.

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APPENDIX A – PROTOCOL (FINAL VERSION)
Neurofunctional assessment protocol for choice of alternative communication resource

Functions of Joints and Bones		
	Qualifier	Moment
Mobility of the cervical joints	M ( ) S ( ) C ( )	
Mobility of the shoulder joint	M ( ) S ( ) C ( )	
Mobility of wrist joints	M ( ) S ( ) C ( )	
Mobility of the joints of the hands	M ( ) S ( ) C ( )	
Mobility of the joints of the feet	M ( ) S ( ) C ( )	
Mobility of hip joints	M ( ) S ( ) C ( )	
Control of voluntary cervical movement	Only ( ) Multiple ( ) M ( ) S ( ) C ( )	
Control of voluntary movement of the hand	Only ( ) Multiple ( ) M ( ) S ( ) C ( )	
Control of the voluntary movement of the arm	Only ( ) Multiple ( ) M ( ) S ( ) C ( )	
Control of voluntary movement of the lower limbs	Only ( ) Multiple ( ) M ( ) S ( ) C ( )	
Control of the right side movement	Only ( ) Multiple ( ) M ( ) S ( ) C ( )	
Mobility of the shoulder blade bones	M ( ) S ( ) C ( )	
Mobility of the bones of the pelvis	M ( ) S ( ) C ( )	
Mobility of carpal bones	M ( ) S ( ) C ( )	
Mobility of tarsal bones	M ( ) S ( ) C ( )	
General control of the joints	M ( ) S ( )	
Muscle Functions		
	Qualifier	Moment
Functions related to the muscular strength of the head	Isotonic ( ) Hypotonic ( ) Hypertonic( ) Isolated ( ) Group ( ) F ( ) R ( )	
Functions related to muscular strength of the upper limbs	Isolated ( ) Group ( ) F ( ) R ( )	
Functions related to muscle strength of the lower limbs	Isolated ( ) Group ( ) F ( ) R ( )	
Functions related to muscle strength of hands	Isolated ( ) Group ( ) F ( ) R ( )	
Functions related to the muscular strength of the feet	Isolated ( ) Group ( ) F ( ) R ( )	
Functions related to muscle strength	Right Side D ( ) Left Side( ) Lower Half ( ) All Limbs ( )	
Functions Related to Movement		
	Qualifier	Moment
Functions related to postural reflexes		
Functions related to stretching tonic reflexes		
Hyperreflexia		
Hyporreflexia		
Functions related to involuntary movements		
Stereotypes and perseveration		

Vision and related functions		
	Qualifier	Moment
Acuity		
Field		
Binocular		
Monocular		
Eyelid		
Direction		

Functional conclusion	
Low-Tech Resources	
Board	YES ( ) NO ( ) WITH ADAPTATION ( )
Looking board	YES ( ) NO ( ) WITH ADAPTATION ( )
Table	YES ( ) NO ( ) WITH ADAPTATION ( )
Panels	YES ( ) NO ( ) WITH ADAPTATION ( )
Book	YES ( ) NO ( ) WITH ADAPTATION ( )
Binder	YES ( ) NO ( ) WITH ADAPTATION ( )
Folder	YES ( ) NO ( ) WITH ADAPTATION ( )
Album	YES ( ) NO ( ) WITH ADAPTATION ( )
High-tech resources	
Computer Mouse	YES ( ) NO ( ) WITH ADAPTATION ( )
Eye tracker	YES ( ) NO ( ) WITH ADAPTATION ( )
Keyboard Hive	YES ( ) NO ( ) WITH ADAPTATION ( )
Vocalizer	YES ( ) NO ( ) WITH ADAPTATION ( )
Computer	YES ( ) NO ( ) WITH ADAPTATION ( )
Tablet	YES ( ) NO ( ) WITH ADAPTATION ( )
Pressure Trigger	YES ( ) NO ( ) WITH ADAPTATION ( )
Possible creative movements for triggers	
Blinking	YES ( ) NO ( )
Aiming	YES ( ) NO ( )
Eyebrow Movement	YES ( ) NO ( )
Cervical movement	YES ( ) NO ( )
Shoulder movement	YES ( ) NO ( )
Blowing	YES ( ) NO ( )
Jaw movement	YES ( ) NO ( )
Hand movement	YES ( ) NO ( )
Wrist movement	YES ( ) NO ( )
Arm movement	YES ( ) NO ( )
Finger movement	YES ( ) NO ( )
Leg movement	YES ( ) NO ( )
Foot movement	YES ( ) NO ( )
Toe movement	YES ( ) NO ( )
Pointing	YES ( ) NO ( )

Subtitle: 1st Moment: Evaluation during the time of therapy - low technology (Observation); 2nd Moment - Functional evaluation with induced activities so that the movement happens - high technology; 3rd Moment - Specific evaluation - with the researcher of computer science. Qualifier: Function and Structure: 0 No deficiency; 1 Mild deficiency; 2 Moderate deficiency; 3 Severe deficiency; 4 Complete disability. F = Force R = Resistance M = Mobility St = Stability C = Control Rig = Rigidity Sp = Spasm