

DOI: 10.15225/PNN.2020.9.1.6

Augmentative and Alternative Communication Systems with Signs and Eye Tracker Used in Poland

System komunikacji alternatywnej i wspomagającej wraz ze stosowanymi znakami oraz wykorzystanie urządzenia sterowanego za pomocą oczu w Polsce

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Abstract

Patients who do not communicate verbally or speak in an understandable way are a serious problem in providing appropriate care to patients due to a lack of understanding of their needs. Therefore, it is important that nursing staff have the knowledge and skills of alternative and assistive communication to communicate with patients with speech disorders. The purpose of article is to present the current state of knowledge of the alternative and augmentative communication with special consideration the signs used in Poland with a particular emphasis laid to the relevant description of the eye tracking device. The literature has been reviewed, including also in this relation topics: alternative and augmentative communication, examples of signs used in alternative communication in Poland and communication and eye tracking. Not everyone has the ability to communicate verbally with the environment. In relation to this problem the solution is the alternative and augmentative communication which uses signs and devices to enable the patient to communicate with other people. (JNPN 2020;9(1):39–45)

Key Words: alternative communication, augmentative communication, AAC system, speech disorders, eye track, C-Eye

Streszczenie

Pacjenci nie komunikujący się werbalnie lub mówiący w sposób niezrozumiały stanowią istotny problem w zapewnieniu właściwej opieki chorych w wyniku braku zrozumienia ich potrzeb. Z tego względu istotne jest posiadanie przez personel pielęgniarski wiedzy i umiejętności w zakresie komunikacji alternatywnej i wspomagającej by porozumieć się z pacjentami z zaburzeniami mowy. Celem pracy jest przedstawienie dotychczasowego stanu wiedzy na temat systemu komunikacji alternatywnej i wspomagającej ze szczególnym uwzględnieniem wykorzystywanych znaków w Polsce oraz opis urządzenia sterowanego za pomocą oczu. Dokonano przeglądu literatury w zakresie tematów: komunikacja alternatywna i wspomagająca, przykłady znaków stosowanych w komunikacji alternatywnej w Polsce oraz komunikacja za pomocą oczu. Nie każdy człowiek posiada zdolność do komunikowania się werbalnie z otoczeniem. W odniesieniu do tego problemu rozwiązaniem jest komunikacja alternatywna i wspomagająca, która stosuje między innymi znaki oraz urządzenia, dające pacjentowi możliwość komunikowania się z ludźmi. (PNN 2020;9(1):39–45)

Słowa kluczowe: komunikacja alternatywna, komunikacja wspomagająca, system AAC, zaburzenia mowy, okulografia, C-Eye

Introduction

According to the American Speech-Language-Hearing Association (ASHA), the AAC is a decision-making system that considers individual communication methods and determines their effectiveness in people with various speech disorders on a temporary or permanent principle, depending on the etiology of the disorder and the objectives of the AAC [1]. AAC program consists of the four fundamental elements including symbols, strategies, techniques and help. There are available various types of the above-mentioned symbols, such as graphic, auditory, gesticular or tactile [2]. Symbols can be created by the sender without any assistance, for instance: ritual gestures and facial expression or with applying aids, such as objects and images [3]. Beukelman et al. pointed out three main goals of the strategy: a) improving the synchronization of messages; b) help in the grammar of message formulation and c) increase the speed of communication [4]. Strategies include procedures that ought to increase the transmission speed or the time needed for searching appropriate messages. With references to the techniques, various methods of message transmission are universally used. Two basic methods, indirect or screening and direct selection require variety of means in order to enable people to communicate [5]. The scanning requires that a person should participate auditory, visually or tactilely, while retaining the thought or message they would like to communicate [6]. The term “help” refers to an electronic, as well as non-electronic device that is used to transmit or receive messages. The phrase help in this sense may differ from the simple devices (e.g. a telephone or photo attached to a piece of paper or a single message stored on one device).

The purpose of article is to present the current state of knowledge of the alternative and augmentative communication with special consideration the signs used in Poland with a particular emphasis laid to the relevant description of the eye tracking device.

Review

Statistic

The demographic research in North America shows that about ~7.5 million people have serious communication problems to such extent that they are unable to use speech and/or handwriting for everyday communication needs [7]. Beukelman et al. examined existing demographic data and estimated that between 0.8% and 1.2% of the United States population had communication disabilities serious enough to require

the AAC system. It was estimated that in Canada ~1.9% of the population over the age of 15 has difficulty in speaking [8]. An Australian study in the province of Victoria which is resided by approximately 4 million inhabitants, indicates that 0.13% of people were unable to speak [9]. The only data concerning European countries come from the United Kingdom where approximately ~800.000 people (1.4% of the population) have serious communication disorders [10]. Currently, there is not in Poland any statistical data concerning people who use AAC system.

Examples of Signs in AAC Systems Used in Poland

There is limited published research into the issues surrounding AAC systems usage and implications in Poland. Although, this section describes the examples of signs in AAC system used in Poland, enlists as well as outlines its assessment among Polish population. The pictogram ideogram communication (PIC) symbols contain about ~400 drawings, black contours of symbols on a white background with signature. All pictograms are divided into 26 word categories, describing the whole surrounding reality, e.g. characters, body parts and clothing/personal items. The subsequent method constitutes the simple pictograms that are represented as the white contours symbols on a black background. Another method which is undoubtedly worthy of mention represents the rebus system that is characterized by the pictographic symbols representing the whole words or parts thereof. The rebus may contain the symbol of the object, its name or part of the word, e.g. phonemes or syllables. Therefore, manual signs are also used with the aim of, for instance completing the message by displaying [11]. Consecutively, method of natural gestures constitutes the set of very simple gestures, usually describing activity or subject [12]. Gestures could be interpreted differently according to the situation in which they are used to support their understanding. Another discussed system of gestures supporting communication is named SIS contains around 550 gestures, symbolizing different parts of speech what makes it possible to build simple statements [13]. Presented gestures remain simple, frequently close to natural, symbolizing the given activity or object (so-called descriptive gestures) and engaging their hands. Using gestures in combination with speech supports in this case the development of passive speech, as well as stimulates motor activity of speech [14]. The picture communications symbols (PCS) is regarded in Poland and similarly in other countries in the world as the most popular, transparent and undisturbed symbol system on account of the fact that it distinguishes in unquestionable flexibility and coherence [15]. The system consists of

about ~3500 colorful symbols that illustrate the meaning of the word, the usual phrase, the polite phrase, e.g. “I have done it”, “Thank you” or “Ask”. The another system that is used in Poland consecutively covers the point alphabet for the hand and contain another method where the right hand touches the left hand of the deaf-blind person. The map of letters arranged on the palm of the hand is based on the frequency which is characteristic for certain combinations of letters that appear in Polish words [16]. Consecutively, the followed used Coghomo system contains about ~100 characters, these are mainly natural gestures, concerning the everyday life concepts, including the polite phrases, activities and feelings after language adaptation [17]. Tadoma is further method commonly used in Poland with particular reference to deaf-blind people [18]. It involves sensing the vibrations and movements of the muscles of the lips, cheek and neck of the speaker [19]. The palm is placed in a way that the thumb touches the lips and the other fingers are on the face from the zygomatic arch to the neck. Finger alphabet is a method of transferring characters of letters, numbers and additional characters (single-letter words and signs of arithmetical operations) with the usage of fingers [20]. This system is close to the writing and reflects the text letter by letter. The signs defining the numerical concepts consist in the counting of the fingers in the hands and the use of contractual marks. Moreover, the finger alphabet is transmitted simultaneously with speech [21]. Classically, in Poland the Braille alphabet serves the blind people to read by touch the systems of six points, arranged on the perimeter of the rectangle [22]. The system consists of characters being the combination of six convex points arranged in the two columns with three points for each. Various numbers of points and their diverse configuration allowed to create 63 characters. In Polish population the adopted Makaton system uses graphic drawings, as well as gestures which support the verbal communication and serve as an additional means that strengthens the message transmission [23]. Apart from the manual signs, there are, graphic symbols which are applied in Makaton and that are used by people who are unable to make a gesture, then they indicate the symbol and in this way they signal their needs and interests [24]. Commonly, the mime as well as the pantomime constitute the techniques of presenting moods, feelings, emotions, certain activities, concrete and abstract issues through gestures, movements of the whole body, as well as the facial expressions [25]. On the other hand, the Aladdin system constitutes the dictionary with over ~1000 separate images resembling the PCS system. Further discussed systems in Poland covers given symbols, consisting of the items identified with the specific situation. The Premack word blocks covers system used in the United Kingdom and in the United States of America with the aim of teaching mainly

mentally disabled and autistic people, blocks can be made of wood or plastic in various shapes [26]. Furthermore, the LÖB system has been introduced and tested over many years in Germany on people with the seriously disturbed communication, including a large group of mental disabled and autistic children [27]. The basic level contains 60 cards including pictures, the advanced one contains 180 cards with the individual symbols on them. Furthermore, the Blissymbolics constitutes the dictionary with approximately ~3000 symbols that represent 6000 words. The users of Bliss, depending on their functional capabilities, indicates the signs by using hand, leg, nod or blinking eyelids. They are able to both indicate single symbols and build the whole sentences with the usage of the greater number of them [28]. Another system that is worth mentioning covers the moving symbols. That represents the communication method that is located between the presymbolic communication and the formal language systems, such as speech or hand signs. The significant symbols can consist of the three-dimensional whole or partial objects [29]. The Signed Polish (pol. System Językowo-Migowy; SJM) constitutes the manually coded form of Polish that utilize the signs of Polish Sign Language (pol. Polski Język Migowy; PJM) [30]. It covers the natural sign language created on the basis of the development of the deaf community in Poland. It covers the natural sign language created on the basis of the development of the deaf community in Poland. This system includes the usage of verbal, visual and gesture messages and on that way facilitates the communication between deaf and hearing persons [31]. Another method that is familiar in Polish conditions covers cued speech consisting of the combination of one-hand gestures and speech. Phonogests have been developed in order to enable the deaf and hearing people to talk to each other [32]. The person who hears and uses phonogests transmits in this way a sound language to the deaf person [33]. The SIG system constitute the ideograms and pictograms represented by the lines that are based on the American Sign Language (ASL) which is a written form of sign language [34]. Moreover, the Goldstein and Cameron hand speech card constitutes the method that consists in using the set of 20 self-care hand signals used to communicate with people suffering from aphasia [35].

AAC Systems-related Technologies and Solutions

A review of the AAC literature concerning the advanced technologies in communication proves that devices have a beneficial effect in the area of patient communication with the environment, as well as in the diagnostics area [36]. There are reports that pertain the application of the three types of technology, comprising

speech devices, voice generator software installed on the personal patient computers, as well as the instruments that facilitate the use of computers [37]. In the case of the assistive technology, the possibility to control the device by the users in a way that is accessible to them is regarded as the crucial issue [38]. They can be controlled by: sight, sound or touch, for instance using a mouse, joystick, touch screens, graphics tablets and electronic pens [39]. Currently, the control technology also includes gestural control, including the ability to use hand signs or gestures in order to control the computer or other personal devices [40]. In some cases, on account of the central nervous system damage the only means of transmission of messages and communication remains the usage of vertical or lateral eye movement or blinking [41]. It should be stated that devices controlled by eye movement are considered to be the most appropriate for such people. In recent years, eye-track has been going through a series of changes, becoming more affordable and more willingly used by an increasing number of people with reduced mobility [42]. The eye-track devices have been developed for a wide range of purposes, including communication with the environment [43].

C-Eye Device

The eye tracker is regarded as one of the device that systematically gains popularity in Poland. Popular eye tracker (C-Eye) offers the opportunity to diagnosis, neurorehabilitation and communication with the environment to people suffering from the various type of brain damage, comprising hypoxic-ischemic events (e.g. perinatal incidents, sudden cardiac arrest or stroke), as well as neurocranial injuries. The device itself consists of a monitor mounted on a movable extension arm with a metal boom, giving the possibility of setting directly in front of the patient's face. The coding unit in this case covers a computer with the installed software. Consecutively, the two infrared light sources are situated symmetrically and uniaxially infrared sensitive camera consisting together so-called movable attachment [44]. The work and the contact with the system is based on the visual contact with the recording device. The patient focuses for the limited time on the appropriate element displayed on the screen, whereas in this time device reads the current position of the eyeballs. Before starting work the screen should be placed in front of the patient's face at the appropriate registration distance. Whether the device correctly reads the position of the eyeballs is checked after the initial parameterization by means of calibration. Then, in the screen of the monitor, it is observed whether the miniatures of the eyes are displayed. After the calibration, apart from the thumbnails of the eyes, a cursor that appears in the form of a red dot,

reflects the location of the patient's eyesight fixation [44]. The eye tracker system consists of three parts, two basic modules such as neurorehabilitation, communication with the entertainment and the third part constitutes database which allow to collect data from the conducted exercises [45]. The first module is used for exercises, among others visual-spatial functions, speech, memory, thinking and imagination, as well as communication skills exercises. In the spatial and visual functions section, one of the available tasks consists in searching for differences between images. In this task, two pictures are displayed on the screen. To select an element, the patient has to focus on the part of the picture on which the difference is visible. Three types of tasks are available in the memory exercises, where one of them concerns the time orientation, for example, distinguishing the seasons. The exercise of thinking and imagination consists, among others, in adapting a picture depicting emotions to the appropriate signature or performing math problems. In turn, in case of the communication skills exercises, the patient has the opportunity to react to the displayed pictogram, selecting from the list of available answers. Additionally, the eye tracker is equipped with the module that enables the assessment of the patient's condition, while its database allows adding and analyzing data for many patients. The common and used tests of cognitive functions are performed using test tools (which mostly require verbal contact with the patient), neuroimaging methods or dichotomies (used to assess attention) [46]. In this case the eye tracker allows the assessment of cognitive functions to people who cannot communicate verbally and do not have any mobility options to convey their needs in any way [47]. In 40% of such injuries, the vegetative state is found in relation to the patient receiving such diagnosis and consecutively usually after 14 days of coma in the hospital the decision is taken to stop further resuscitation and rehabilitation efforts for the palliative care [48]. Frequently, there are not any further attempts made in order to communicate with the patient.

Conclusions

The article presents the general outline of the AAC system and disease entities that require its application taking into consideration the symbols used along with the latest technological help on the Polish market. The emerging new devices used in AAC remove to some extent obstacles in the lives of people with disabilities who on account of their functional limitations frequently feel isolated from the rest of society. One of the latest inventions is the C-Eye device constituting the integrated system controlled by the eye movement. It offers the patients with dysfunctions and post-comatose which

prevent them from verbal communication the opportunity to communicate. Further development of this field is crucial to meet everyday communication needs of people who have difficulties in communicating with the environment, as well as to improve their health-related quality of life.

Implications for Nursing Practice

According to the research carried out by Simmons et al. (2019) Nurses reported limited AAC knowledge but expressed a desire for support to use AAC with their patients. Taking into consideration the range of disorders as an Alzheimer's disease sufferers require special attention whereas AAC devices or its components would be the most valuable for this patients population [50]. Other disorders that patients could benefit from the usage of AAC system include learning disabilities, stroke, cerebral palsy, traumatic brain injury (TBI) and motor neuron disease [51,52]. Given the review of a number of disorders, consideration should be given to the need for AAC training for nursing staff to facilitate their work with patients who do not communicate verbally or have any difficulty in communicating their needs.

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Conflict of Interest: None

Funding: None

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(A — Concept and design of research, B — Collection and/or compilation of data, C — Analysis and interpretation of data, D — Statistical analysis, E — Writing an article, F — Search of the literature, G — Critical article analysis, H — Approval of the final version of the article)

Received: 5.01.2020

Accepted: 4.03.2020