Communication Supports for People With Motor Speech Disorders

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Communication supports for people with motor speech disorders can include strategies and technologies to supplement natural speech efforts, resolve communication breakdowns, and replace natural speech when necessary to enhance participation in all communicative contexts. This article emphasizes communication supports that can enhance participation, as described in the World Health Organization's International Classification of Functioning, Disability and Health. The article begins with a discussion of partner and patient-reported assessments to evaluate participation levels and barriers to participation. Then, it provides an overview of communication supports for speakers with motor speech disorders, organized by the status of the disorder as stable, improving, or degenerative. The article includes nine case examples to illustrate principles and provide examples of how to address stable and changing needs. **Key words:** *alphabet supplementation*, *augmentative and alternative communication*, *communication partner*, *digital images*, *dysarthria*, *motor speech*, *photographic supplementation*, *topic supplementation*

THIS ARTICLE describes the use of communication supports, also referred to as augmentative and alternative communication options, to assist adult speakers with motor speech disorders to communicate more effi-

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ciently and effectively. The focus is on the use of supports and strategies to enhance spoken communication, and with it, participation and independence in a variety of situations.

Individuals with a range of diagnoses and severity levels can have motor speech disorders. Some individuals have motor speech disorders as primary concerns; others have them concomitant with language or cognitive-communicative impairment. Individuals with motor speech disorders can be described as either stable (chronic with no changes), recovering, or degenerating in their motor speech abilities. These pervasive conditions have a substantial impact on participation in home, work, and community settings. The following case example is a composite of cases facing similar issues. It is used to illustrate the impact a motor speech disorder can have on a person's participation and autonomy.

Case example 1. A 28-year-old man with spastic cerebral palsy had recently moved from his parents' home to an assisted living facility as his next step toward achieving his personal goal of increasing independence as an adult. He had spastic dysarthria, with an intelligibility level of only 40% at the sentence

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level, and spent the majority of his life communicating with close friends and family using his natural speech, which was dysarthric but mostly intelligible to those who knew him well. However, when this young man made his first unassisted visit to a bank to set up a bank account, he was extremely frustrated with the bank teller's inability to understand him. As he became more frustrated, his spasticity increased, and his speech became less intelligible. The bank staff, alarmed by his increasing spasticity, contacted emergency personnel, as they thought he was having a health crisis. The emergency medical technicians arrived, determined where the man was residing, and called the director of the assisted living facility so that he could come to the bank. The individual was embarrassed and angry about the events that occurred. He realized that he had no method or way to support his communication attempts for use in such circumstances. He had always relied on his natural speech because his environment typically contained individuals who knew him well, and he had always been accompanied by a family member or friend. In order for him to participate in this new environment and meet his goals (increasing his independence), he needed access to strategies to support accurate communication with new and unfamiliar listeners.

PARTICIPATION AND RELATED ASSESSMENT TOOLS

Participation is a key component in the World Health Organization's International Classification of Functioning, Disability and Health (World Health Organization, n.d.). This framework provides a model comprising impairment, activity, and participation. Motor speech disorders are assessed and diagnosed at the *impairment* level (e.g., decreased respiratory support, velopharyngeal incompetence, and imprecise articulation). Their impact on function is measured at the activity level (e.g., objective speech intelligibility measures). Participation may be assessed informally or with tools such as the Communica-

tion Effectiveness Survey (Donovan, Velozo, & Rosenbek, 2007) or the Social Networks Assessment (Blackstone & Hunt Berg, 2012) described later. Application of communication supports is driven by the participation level. Participation refers to how well an individual manages interactions in societal contexts. The construct of participation takes two factors into account: performance of the individual with a motor speech disorder and the response of their communication partner(s). Participation goals, along with consideration of the state of the speaker's neurological condition (i.e., stable, recovering, or degenerative), drive clinical decision-making and interventions related to communication supports for people with motor speech disorders.

Participation for persons with motor speech disorders may be best assessed through patient-reported outcome measures that document the individual's perspective on his or her communication (Donovan et al., 2007). For example, the Communication Effectiveness Survey, first introduced by Yorkston, Beukelman, Strand, and Bell (1999), revised by Ball, Beukelman, and Pattee (2004), and further revised and validated by Donovan et al. (2007), is an eight-item survey that documents change in participation levels from baseline to posttreatment for motor speech disorders. The survey uses a four-category response scale (from 1 = "not at all effective" to 4 = "very effective") to gather input about communication effectiveness in different contexts such as conversing with a family member or friends at home, having a conversation in a car, or with someone at a distance. In our clinical practices, we have used the Communication Effectiveness Survey with family members of individuals with motor speech disorders, as well as the individuals themselves, to compare perspectives. This can help individuals understand the degree to which their communication effectiveness is impacted by their dysarthria, even with people who know them well.

Another tool that captures the participation aspect of communication disorders is the Social Networks (Blackstone & Hunt Berg,

2012) assessment protocol. It uses comprehensive and systematic information gathering and observation procedures to obtain information about the individual's communication strengths, environments, communication partners, and differences in the partners' ability and willingness to support the individual's communication by learning new strategies. The protocol does not require training to administer. The administrator gathers information from multiple sources including interviews with the individual with the communication disorder (if possible), a family member, and someone who is a paid communication partner (such as a direct service professional, personal care attendant, teacher, or speech-language pathologist). The protocol identifies the individual's communication modalities, strengths, and assistive technologies used, and further matches those categories to communication partners with whom they are used. For example, the individual may communicate effectively with a speech-generating device but only use it with certain partners who are willing to accommodate that modality. Ultimately, the Social Networks protocol leads to a summary of communication strengths, modalities, and partners who are most willing to support communication or learn new supports, and guides the user in setting intervention goals. It is useful at the participation level as a pre- and posttest to demonstrate change after intervention for individuals with motor speech disorders.

SUPPORTS RELATED TO MOTOR SPEECH DISORDER STATUS

Varied strategies could be used to support natural speech by people with motor speech disorders whose primary communication challenges are with speech intelligibility. An overview of common speech supplementation supports for individuals with motor speech impairments appears in Table 1. The four categories of supports summarized in this table are gestures, photographic supports, alphabet supplementation, and topic supplementation. The sections that follow offer

information and case examples to illustrate how to select among such supports and individualize them to address participation needs of individuals whose motor speech disorder status is stable, recovering, or degenerative.

Supports when motor speech impairment status is stable

Congenital neurologic conditions are often stable or chronic in their status. A report by the Centers for Disease Control and Prevention (2017) indicated that cerebral palsy is the most common motor disability in children, with worldwide prevalence reports that range from 1.5 to more than 4 per 1,000 live births. In the majority of cases, individuals with cerebral palsy have a motor speech impairment, and these conditions are relatively stable into adulthood. Other congenital neurologic conditions, such as Duchenne and Becker muscular dystrophy, also cause relatively stable, persistent motor speech impairment (Bushby et al., 2009). Acquired neurologic conditions that arise from brain injury or stroke may result in a stable and chronic dysarthria or apraxia of speech after a period of recovery. Cerebral palsy and other chronic and stable motor speech disorders are often resistant to traditional behavioral intervention approaches that focus on speech subsystem remediation (Hustad, 2010), which means that improving participation and functioning may rely more on provision of communicative supports than on communicative interventions aimed at reducing impairment.

Individuals with stable motor speech impairment may rely on speech for most communication interactions, but experience difficulty conveying detailed information. They communicate most effectively with familiar communication partners but find speaking with unfamiliar partners to be challenging, as in case example 1. Interacting with health care providers and other service providers may be especially fraught with frustration and anxiety when important or complex information is at stake. Case example 2 shows how, for one person with chronic speech motor

Table 1. Common speech supplementation techniques including a description of the technique, the modality used in the technique, benefits of the technique, and associated references

Speech Supplementation Techniques	Description	Modality	Benefits	References
Gestures	Moving a body part to suggest action, without words (e.g., holding a spoon, dipping into imaginary bowl, and bring to mouth)	• Body—no extra system or tools needed	• Natural • Usually easy to guess • Shown to be as effective as other supplementation strategies	Hustad and Garcia (2005)
Photographic supports	Digital/photographic images	• Printed photographs • Mobile devices (i.e., phones and tablets) • Communication software on speech-generating devices	• Mobile technologies increase access to incorporating real-time digital images • Web-based image search tools provide easy access to a wide range of digital images • Augments speech by providing context or supplementing content with detail that is not easily spoken	Beukelman, Taylor, and Ullman (2013) Hanson et al. (2013) Van Dijck (2008) Schiano, Chen, Coreena, and Isaacs (2002)

(continues)

Table 1. Common speech supplementation techniques including a description of the technique, the modality used in the technique, benefits of the technique, and associated references *(Continued)*

Speech Supplementation Techniques	Description	Modality	Benefits	References
Alphabet supplementation	Speaker points to the first letter of each spoken word	• Laminated paper printed with letters and short phrases • On-screen keyboard on tablet device • On-screen keyboard on speech-generating device (may also include word prediction list)	• Helps communication partner perceive word boundaries by slowing speaking rate • First letters provide phonemic cues to assist the communication partner in perceiving the initial phoneme • May increase articulatory accuracy	Fercho, Baugh, and Hanson (2015) Hanson et al. (2013) Hanson et al. (2004) Hustad and Lee (2008)
Topic supplementation	Speaker points to a specific item in a list of topics at the beginning of an utterance	• Laminated paper with topic words • On-screen display on tablet device or speech-generating device	• Provides the topic of the spoken message, which allows communication partner to guess spoken words	Hustad, Jones, and Dailey, (2003)

impairment, photographs helped to fill the gap between basic and detailed information.

Case example 2. An 83-year-old woman had a series of cerebral vascular accidents in her 70s that left her with flaccid dysarthria characterized by imprecise articulation and hypernasality/nasal emissions, making it difficult for communication partners to understand her natural speech. Yet, she relied on natural speech as her primary communication modality. Despite a slight right hemiplegia, she lived alone in her home with assistance from a home health provider for weekly shopping, light house cleaning, and some meal preparation. Her two adult children and grandchildren lived several hours away. When reading the local newspaper, she used the flyer insert from the local grocery store to circle items that she wanted to purchase during their weekly grocery trips. She also saved the weather forecast to show her staff if she wanted to take care of something outside, such as water her plants if the forecast was hot and dry. She was adept at using personal photographs to supplement her speech. For example, when asked who sent her a box of chocolates she retrieved a photograph of a friend and, through gestures, limited speech, and the photograph, communicated that he was an old friend who lived far away and sent her candy every year.

Because of this existing communicative strength in using graphic supports to communicate, her speech-language pathologist suspected she would be successful with simple digital photography to extend her capabilities for detailed communication. Her family eagerly bought her a smaller tablet device, and her speech-language pathologist integrated it into therapy sessions by teaching her how to access the camera application to take photographs and then retrieve them to show communication partners during conversations. She demonstrated mastery of this form of supplementation when she took a photograph of her bathtub as a way to explain to her doctor that she had difficulty stepping into the tub independently. Again, through her limited speech ("no way! no way!"), the photograph

of the tub on the tablet, and gesturing to her weak right leg, she communicated about the challenge of bathing, and her doctor wrote orders for a biweekly bath aide and physical therapy from a home health agency. This combination of supports allowed her to remain an active participant in her family and in directing her health and medical care.

Special considerations for supports when conditions are stable

Speech supplementation with topic cues (i.e., pointing to the topic of an utterance, such as "pets" before talking about a new puppy) or the use of first-letter cues, can support intelligibility for people with stable motor speech disorders of varied types. Such supports are usually not necessary for communicators with stable conditions in situations with familiar partners, but they may be useful to establish topics and repair communication breakdowns with unfamiliar communication partners. Therefore, self-awareness of communication effectiveness is important, as the speaker must be aware of communication breakdowns and remember to use the repair strategy. A focus in therapy on self-monitoring skills and strategic use of a supplementation display with letters, words, and photographs to repair communication breakdowns can be used to support successful communication.

Individuals with stable status may reside in living environments involving consistent communicative partners, such as family members, or with consistent staff in group homes, assisted living facilities, or long-term care facilities. For individuals with stable motor speech disorders, residential transitions may occur only when higher levels of care are needed related to aging or illness. In some living facilities, however, they may experience many changes in communication partners because of the high turnover of direct support providers and other nonfamily caregivers. The challenge then becomes training new caregivers, who begin as unfamiliar communication partners, to adapt to the individual's communication repair strategies. Communication partners need explicit

training to use communication support strategies and facilitate the individual's use of communication supports to repair communication breakdowns. For example, partners may need to learn that it is acceptable to ask "What's the first letter?" to cue the use of alphabet supplementation when a word is not understood. Or they may need to ask for the topic of conversation while pointing to a topic display, or to ask to see a picture to understand more details.

Another situation that may pose a challenge for individuals with chronic motor speech disorders is telephone communication. The challenges are caused by the limited acoustic signal that transmits the already degraded speech signal (Hanson, Goldhammer, & Bethard, 2016; Hanson & Sundheimer, 2009), along with not seeing the speaker's face and mouth, which would provide visual information (i.e., speech reading). In such situations, individuals with motor speech impairment may point to first-letter cues, which can improve intelligibility although the communication partner cannot see the letter cues during a telephone conversation. Research shows that speech intelligibility increases during alphabet supplementation, even when the letter cues are not visible (Hanson, Yorkston, & Beukelman, 2004), perhaps because it slows the speaking rate and results in more accurate articulatory targets (Hustad & Lee, 2008). Beukelman and Yorkston (1977) reported an increase in speech intelligibility and communication effectiveness when a speaker with dysarthria pointed to first-letter cues during phone conversations with familiar communication partners. Also, given the variety of options for distance communication through visual platforms, such as voice over Internet protocols like Skype and FaceTime, people with motor speech disorders who rely on natural speech can participate in face-to-face conversations, which may improve their communication effectiveness. Case example 3 shows how such programs can support communication for a person with dysarthria.

Case example 3. The same 83-year old, who lived alone after a left hemisphere cerebral vascular accident, enjoyed weekly FaceTime visits with her children and grandchildren on the tablet device purchased by her family. Although she needed assistance to open the application and initiate the call, she learned to pick up the tablet and change the camera direction to show her family items that she could not otherwise describe. For example, when she received a bouquet of flowers from her brother and sister-in-law, she told her grandchildren about it by pointing the tablet at the bouquet on the table and then at the greeting card that accompanied it when they asked who sent the flowers.

Chronic conditions involving limited natural speech

Topic supplementation and alphabet supplementation can make it possible for an individual to communicate with limited natural speech, although in some cases a speech generating device provides a modality for expressive language when natural speech is ineffective. A speech generating device may offer an alternative to natural speech or may be used to repair communication breakdowns, even when supplementation supports are used (Hanson, Beukelman, & Yorkston, 2013). In addition, many of the speech generating devices currently available support digital photographs and videos, which can also supplement natural speech by adding detail to the basic message or carry a greater portion of the message for an individual who is nonspeaking. Identifying which communication supports and systems are appropriate for different settings and situations can help the communicator increase effectiveness and decrease the frustration and isolation that often accompanies severe communication impairment. The following example shows how a speech-language pathologist balanced the need for some speech output with the preferences of her client.

Case example 4. A 29-year-old woman with cerebral palsy lived alone in a ground-floor apartment and walked with an extremely ataxic gait. Her speech was severely dysarthric and limited to vocalizing, which

was insufficient for supporting effective communication. She did not want a portable speech generating device but preferred a small communication book that contained letters, punctuation, numbers, a section of short phrases and topic words, as well as personal photographs that she used to communicate details about common topics (see Table 1) and personal information. She had sufficient fine motor skill to handle the book, locate the desired page, and point to words, letters, and photographs. However, she needed voice output for telephone calls, which was her connection to family and method for scheduling public transportation rides. Together with her speech-language pathologist, she determined that the solution for this need was a large computer with speakers that supported synthesized speech output software, which allowed her to preprogram messages and to spell novel messages when needed. Intervention focused on teaching her how to preprogram messages and how to identify potential communication breakdown and repair strategies during phone calls. A high-quality speakerphone was placed near the computer speakers to pick up the synthesized speech output of the desktop system. She used this system to schedule rides and appointments. She also used the system to call the speech-language pathologist when she needed assistance, such as when she lost her communication book and needed a replacement.

Supports when motor speech impairment is improving

In some cases, acquired neurologic conditions are accompanied by a motor speech impairment that is recovering or improving (Duffy, 2005). These impairments can result from a wide range of etiologies, such as cerebral vascular accident, traumatic brain injury, high-level spinal cord injury, Guillain-Barré syndrome, and myasthenia gravis. Some speakers may present with mild deficits for which they can compensate or that can be remediated with intervention. However, others present with moderate-to-severe impairments that follow a prolonged recovery path. Some researchers have reported functional

speech recovery in excess of 10 years postonset (Jordan, 1994; Workinger & Netsell, 1992). This section describes communication supports for people with varied but improving motor speech patterns.

Many people with improving status may continue to rely on communication support strategies for long term, but their use of different techniques and the contexts in which the strategies are most useful may change as their speech improves. Transitioning through various care settings is not uncommon for this group, as they continue to improve. For example, individuals who have sustained a severe traumatic brain injury have been reported to transition through a full continuum of care in the years after their injury, often including transitions from acute care hospital, to inpatient rehabilitation, to outpatient rehabilitation, to skilled nursing facility, to assisted living, and to community living with home health support (Fager, Hux, Karantounis, & Beukelman, 2006). The caregivers and communication partners can change substantially with each transition for these individuals. With changing communication needs and communication partners over time and across settings, rehabilitation teams might establish someone in the role of communication advocate. Communication advocates are often family members or friends of the individual who requires communication supports. The communication advocate typically has the background information regarding the recommendation, implementation, and evolution of communication supports and can share this information with new caregivers to ensure that these supports continue to be used (Beukelman, Fager, Ball, & Dietz, 2007; Fager, Hux, Beukelman, & Karantounis, 2006; Hemsley & Balandin, 2009).

Communication supports for individuals with improving motor speech impairment can play a unique role in communication effectiveness. First, because these individuals are often working toward recovery of some natural speech, communication supports can be introduced as a temporary means of supplementation early in recovery or when intelligibility is severely impaired. Second, communication

supports can play a direct role in intervention (Beukelman, Nordness, Yorkston, & Hux, 2011; Fager, Doyle, & Karantounis, 2007). For example, techniques such as alphabet supplementation and topic supplementation reinforce strategies often used in intervention by requiring the person to slow his or her speech productions, which, in turn, results in deliberate articulatory placement and increased segmentation of words. Third, as speech improves, intervention may focus on identifying the contexts where communication support strategies may be most effective. For example, intervention may help the person identify when to initiate a strategy during a communication breakdown, rather than continuing to attempt natural speech with no support. In addition, intervention may help the person identify which communication partners (e.g., familiar vs. unfamiliar) require different types of communication supports to understand messages being communicated. Case example 5 illustrates some of these principles.

Case example 5. A 20-year-old man who sustained a severe traumatic brain injury as a result of a motor vehicle accident demonstrated severe mixed spastic-flaccid dysarthria (20% intelligible at word level and 0% at sentence level) at the beginning of his recovery. His recovery included multiple environments and communication partners. Communication supports were initiated in acute rehabilitation to support effective communication between health care providers and the young man (i.e., patient–provider communication; Blackstone, Beukelman, & Yorkston, 2015). They included the use of full message communication boards that had information about basic needs, activity choices for therapy, pain scales, orientation information, and social messages for family/friends. Attempts at natural speech were largely unsuccessful at this level because of the severity of his dysarthria accompanied by cognitive impairments consistent with brain injury (e.g., recall/memory, initiation, and attention). This man's communication supports served as a supplement and at times a replacement for his natural speech attempts. During acute care, communication partners were taught to provide maximal

cueing to help him use his communication supports. As he transitioned to his parents' home and outpatient therapy, his cognitive deficits began to improve and he required less cueing to use his communication supports. He began to initiate the use of the supports to resolve communication breakdowns. As his intelligibility began to improve (60% at word level and 30% at sentence level), he was introduced to alphabet supplementation using a letter board (Table 1). Although he required maximal cues initially to use this strategy, he began to use it with greater independence as his cognitive abilities improved.

At this time, he began to integrate back into limited community settings (e.g., home, social outings with friends and family), and his communication partners were familiar. Intervention focused on continued use of his communication boards and alphabet supplementation with decreasing cues as his natural speech improved. Eventually, he moved out of his parents' home into an assisted living facility. In this setting, his opportunities to communicate with a wider range of partners increased, as did the need for him to manage his communication supports with a greater level of independence. Intervention outcomes were evaluated and new intervention goals were determined with the Social Networks Assessment. Results indicated that his communication partners now included staff/residents of the assisted living facility, unfamiliar people in the community, and people at a local gym. Contexts included face-to-face and telephone communication. It was determined that he would benefit from a support that included synthesized speech output to allow him to participate with greater independence in these contexts. He used a tablet with the Compass[1] application from TobiiDynavox with full messages programmed to support the communication of routine and predictable

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[1]Compass communication software app by Tobii Dynavox, 2100 Wharton Street, Suite 400, Pittsburgh, PA 15203, https://www.tobiidynavox.com/en-US/products/software/

information (e.g., making a doctor's appointment). In addition, he continued to use alphabet supplementation using a keyboard interface in the Compass application. Intervention focused on identifying which support strategies to use given certain contexts (e.g., using alphabet supplemented speech during face-to-face communication breakdowns, using pre-programmed messages, and spelling to communicate over the telephone).

Supports when motor speech is degenerating

In some cases, impaired motor speech status does not improve or remain stable, but degenerates. This occurs when individuals have neurodegenerative conditions such as amyotrophic lateral sclerosis, Parkinson's disease, or multiple sclerosis. Such individuals often experience a deterioration of their motor speech system, resulting in progressing dysarthria (Ball, Fager, & Fried-Oken, 2012; Yorkston, Klasner, & Swanson, 2001; Yunusova, Green, Linstrom, Pattee, & Zinman, 2010). Some individuals progress to complete anarthria (no speech). However, there is often a period where natural speech continues to be a substantial component of these individuals' communication (Ball et al., 2012; Mathy, Yorkston, & Gutmann, 2000). Such an evolving pattern requires special consideration for providing supports for natural speech. The timing of appropriate communication supports can be guided by following a staging approach to clinical decision-making when individuals have declining or degenerative conditions (Ball et al., 2001; Ball, Beukelman & Pattee, 2002; Ball, Beukelman, Ullman, Maassen, & Pattee, 2005; Mathy et al., 2000).

For people with degenerative conditions, participation challenges change over time, requiring ongoing reassessment of needs and adjustment to the supports that are required. Adjustments may occur to the type of support, the kinds of messages included in the supports (alphabet supplementation vs. word/picture boards), and access to the communication support. This is because many individuals with degenerative conditions exhibit decreasing motor abilities with disease progression. As a result, plans, for example, for helping individuals transition from using a touch screen to using eye tracking technology to access a speech generating device may be integrated into intervention (Beukelman & Mirenda, 2013).

To address these concerns, clinicians can use a staging approach to guide clinical decision-making when planning communication supports for individuals with degenerative conditions (Mathy et al., 2000). A staging approach can be designed to accommodate changes associated with five stages in the devolution of speech intelligibility, which are characterized as follows: (1) no detectable speech disorder, (2) beginning evidence of motor speech impairment, (3) reduction in intelligibility, (4) natural speech no longer intelligible without augmentation, and (5) no functional speech (Mathy et al., 2000). Information about stages and examples of supports for changing stages is provided in the sections that follow.

Maintaining participation in Stages 1 and 2 of degenerative conditions

In Stage 1, when no detectable speech disorder is present, it is typically a time when people have recently been diagnosed and their particular diagnosis has not yet impacted their speech production capabilities. This stage often includes education of the person and the family. The role of communication supports can be introduced to prepare the person for future recommendations and provide reassurance that there are techniques and strategies available to support continued life participation as natural speech declines.

As the degenerative condition declines, communication supports can be introduced as the motor speech impairment begins to impact participation. Stage 2 occurs when the motor speech impairment becomes apparent, as indicated by an obvious communication disorder affecting intelligible speech, writing, and functional reading aloud. Although speech may still be intelligible, breakdowns may begin to occur with unfamiliar listeners,

over the phone, or in noisy public settings (e.g., restaurant). Case example 6 offers an illustration of this progression.

Case example 6. A 45-year-old man had bulbar onset amyotrophic lateral sclerosis, which primarily involves speech signs with no evidence of physical limitations yet in arms or legs in the early stages. At the time of this example, he exhibited Stage 2 characteristics in that he noticed that he was required to frequently repeat himself to unfamiliar listeners when in noisy environments, such as in stores, restaurants, or parties. Appropriate communication supports for him at this stage included ways to support writing to clarify messages and supplement natural speech attempts when communicating in noisy environments. Examples included writing with pen/paper, note-taking applications for his smart phone and computer tablets, and a Boogie Board electronic magic slate, which is a device that allows the user to write a message on its surface that can be quickly erased with the press of a button. This individual could manage his communication exchanges using his natural speech in all but a few select contexts. In those, he employed communication supports described earlier, which also prepared him for using similar and additional supports to maintain functioning and participation as his condition evolved.

Maintaining participation in Stage 3 of degenerative conditions

In Stage 3, which is characterized by reduction in intelligibility, individuals experience dysarthria so severe that partners can no longer understand them when they use only their natural speech. At this stage, communication supports begin to play a prominent role in all contexts. Natural speech attempts may still be combined with alphabet supplementation strategies to support the partner's ability to understand the messages being communicated. Written supports may continue to be used if the person has adequate physical abilities. If motor abilities are impaired, alternative access to mobile devices (e.g., using an onscreen keyboard application activated via switch scanning by touching the surface

of the tablet or smart phone) may be appropriate. The following case example illustrates this stage of progression.

Case example 7. A 50-year-old woman with multiple sclerosis recently experienced an exacerbation of her condition. With this exacerbation, her speech intelligibility decreased, she demonstrated increased cognitive deficits (e.g., short-term memory limitations, impulsivity, and problem-solving difficulty) and challenges with vision. She moved in with her daughter because her family and physician were concerned about her safety. Her previous communication supports had included alphabet and topic supplementation (see Table 1) with occasional writing in a small notebook. Although she had primarily relied on her natural speech, she used the other supports to resolve communication breakdowns with listeners who were unfamiliar with her in the community. With the changes in her cognitive abilities, she was no longer able to successfully implement the use of her alphabet and topic supplementation techniques without frequent cues from her communication partners. The text on her supplementation boards was enlarged to accommodate her vision changes. Intervention focused on developing an 8″ × 12″-communication book (including full messages and personally relevant digital pictures for quick recognition of messages), as she began to shift from relying primarily on her natural speech to communicate, to the use of external communication supports in a wide range of contexts (home and community). Intervention at this stage also focused on partner training to cue her to use her supports, identify the contexts where she may need the most cueing/support, and how to add content to the communication book to support any new communication opportunities.

Maintaining participation in Stage 4 of degenerative conditions

In Stage 4, natural communication strategies require supplementation by augmentative techniques to achieve effective communication. In this stage, some of the communication support strategies mentioned

in the earlier stages may still be implemented; however, the use of alternative access devices (e.g., switch scanning), key guards, adaptations to touch screens, and other techniques may be required to augment motor access issues that are common in degenerative conditions. As illustrated with case example 8, communication support strategies continue to be used extensively and begin to replace natural speech attempts more frequently, as intelligibility and the ability to speak decline.

Case example 8. A 70-year-old retired man with Parkinson's disease exhibited severe motor speech impairment coupled with limited hand movement. Previously he had relied on alphabet supplementation (Table 1) at home and a text-to-speech device (Lightwriter SL40[2] by Abilia Toby Churchill) to support his communication in a bible study and during weekly coffee meetings with friends. He required communication partner cues to remind him to use these supports when communication breakdowns occurred because he was experiencing decreased insight into the severity of his speech deficits. Recently, his ability to accurately type on the Lightwriter® had declined, and the high rate of errors was causing him to avoid using his device despite cues. This recent physical decline also limited his participation in the bible study and coffee group, two community activities that he had valued.

Intervention focused on introducing him to the use of a touch screen device (Indi[3] by Tobii Dynavox with Communicator 5[4] software) with access to both a keyboard for spelling and pages with full messages related to the two contexts he enjoyed. These included social messages, messages specific to lessons being discussed in bible study, which his wife could update, and comments he would frequently make during social interactions with his friends at coffee. Touchscreen access modifications were made to the device, including changing the touch screen setting to activate only when a finger is lifted off of the surface. This was used to decrease inadvertent activations. The access methods for this device could be modified in the future if required (e.g., by introducing single-switch scanning), as his condition continued to decline.

Maintaining participation in Stage 5 of degenerative conditions

In Stage 5, when no functional speech is present, individuals typically are nonspeaking and rely on speech generating devices and other strategies as a complete replacement for their natural speech. At this stage, if a person were referred in a timely manner, the formal evaluation for a speech generating device would have already occurred. If such a referral were not made, the evaluation would occur at this stage. The speech generating device would replace speech completely, or nearly so, and intervention would focus on identifying specific contexts in which the device would be used, the primary communication partners, the cues/supports the individual would need to effectively use the speech generating device, and backup systems to support ongoing communication in all contexts. Backup systems could include techniques such as low tech communication displays with letters, words, and phrases and accessed through direct selection (e.g., pointing and eye gaze) or partner-assisted scanning.

SUMMARY AND CONCLUSION

Targeting the participation level of the World Health Organization's model of functioning for individuals with motor speech impairment provides speech-language pathologists, rehabilitation teams, individuals, and

[2]LightWriter® SL40 by Abilia Toby Churchill, Norman Way Industrial Estate, Over, Cambridge CB24 5QE, England, http://www.toby-churchill.com/products/lightwriter-sl40/

[3]Indi speech generating device by Tobii Dynavox, 2100 Wharton Street, Suite 400, Pittsburgh, PA 15203, https://www.tobiidynavox.com/en-US/products/devices/

[4]Communicator 5 communication software by Tobii Dynavox, 2100 Wharton Street, Suite 400, Pittsburgh, PA 15203, https://www.tobiidynavox.com/en-US/products/software/

their families with a path to identify effective communication supports for them. For people who are stable in their recovery, supports must meet a wide range of needs and may require modification, as living situations or new communication opportunities, contexts, and partners are encountered. For people who are recovering, communication supports are needed that can supplement natural speech initially but can be reduced over time, as speech becomes more intelligible. In addition, supports may be limited to contexts with unfamiliar communication partners. For people who are experiencing degenerating conditions, supports grow and expand as their needs change across stages from supplementation to complete replacement of natural speech. A combination of supports that either augment or replace spoken language and provide supplemental information for communication partners addresses the goal of effective communication. As communication partners share in the construction of meaning during conversations, they may take a more active role to guide the speaker to use established communication supports with a focus on effective communication and active participation.

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