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DOWN SYNDROME: AN INVESTIGATION INTO EFFECTIVE ASSESSMENT AND INTERVENTION TO INCREASE OVERALL COMMUNICATION ABILITIES

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DOWN SYNDROME: AN INVESTIGATION INTO EFFECTIVE ASSESSMENT
AND INTERVENTION TO INCREASE OVERALL COMMUNICATION ABILITIES

by

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B.S. Purdue University, 2012

A Research Paper

Submitted in Partial Fulfillment of the Requirements for the
Masters of Science

Department of Communication Disorders and Sciences in the Graduate School
Southern Illinois University Carbondale

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Introduction

Down syndrome is the most common chromosomal disorder in the United States today (Down Syndrome Facts, 2012). According to the National Down Syndrome Society (2012), 1 in every 691 children in the United States is born with Down syndrome. Many of these children will require early intervention services, often from Speech Language Pathologists (SLPs). Because of these statistics, it is important for SLPs to understand how Down syndrome affects speech and language in order to anticipate the needs of future clients. Although every child is different and unique, this paper will examine what characteristics contribute or cause deficits in children with Down syndrome, the major categories of deficit in children with Down syndrome, how SLPs can properly assess children with Down syndrome and what intervention techniques have been researched and supported. First, we will examine what characteristics of children with Down syndrome may cause speech and language deficits.

Characteristics of Down syndrome that may impact communication abilities

Children with Down syndrome often exhibit specific facial features that are evident from a young age. These characteristics include brachycephaly, commonly referred to as flat head syndrome, and the absence of nasal bone ossification (Kent & Vorperian, 2012). Most characteristics are seen at birth and continue to increase in severity until about the age of 14. These facial features cause reduced volumes of airway, mandible, adenoid and tonsils. A smaller mid and lower face, as well as, soft palate can often be observed as well (Kent & Vorperian, 2012). These craniofacial

abnormalities may indeed play a role in how children with Down syndrome produce words and communicate with others. Research has indicated that hypotonia is not pervasive among all children with Down syndrome, but when it is present, it may explain deviant functions in the larynx, velopharynx and oral articulators. These abnormalities may impact the areas of phonation and articulation (Kent & Vorperian, 2012).

A study completed by Cleland, Wood, Hardcastle, Wishart, Timmins (2010), examined if speech disorders in children with Down syndrome is correlated to their language and cognitive abilities. Fifteen children between the ages of 9 to 18 were recruited to participate in a battery of standardized tests, including language and cognitive assessments (Cleland, Wood, Hardcastle, Wishart & Timmins, 2010). Several standardized assessments were used including The British Vocabulary Scales, the Clinical Evaluation of Language Fundamentals- Preschool (CELF-P) and the Diagnostic Evaluation of Articulation and Phonology. The results revealed that participants with Down syndrome displayed deficits in both receptive and expressive vocabulary (Cleland et al., 2010). The authors concluded that these delays cannot be completely contributed to their outlying diagnosis. They also found that articulation is significantly impacted in children with Down syndrome and children who participated exhibited at least one atypical error, besides their developmental articulation errors (Cleland et al., 2010). The authors concluded that the articulation error may not be in indirect correlation to the child's language or cognitive abilities. None- the- less children with Down syndrome who present with articulation errors require early and frequent intervention in order to increase their overall intelligibility (Cleland et al., 2010). There are other factors that may play a role, such as hypotonia, which is discussed in the following section.

Hypotonia

Hypotonia, or muscle weakness, may be a focal point of early intervention therapy for SLPs, occupational therapists, and physical therapists that treat children with Down syndrome. As muscle tone increases, speech targets may be altered for these children. The combinations of factors that affect speech production in children with Down syndrome vary child to child, but many factors are present on the continuum of severity. Speech difficulties in this population may indicate problems stemming from anatomy abnormalities and a lack of motor control (Kent & Vorperian, 2012).

According to Kent and Vorperian (2012), it appears that infants with Down Syndrome have a delay in babbling, but these deficits are minimal compared to delays in their motor skills (Kent & Vorperian, 2012). Although anatomic anomalies may not explain speech disorders in children with Down syndrome, they do appear to affect the child's ability to articulate precisely. Now let's examine the five specific areas of deficit found for speech and language in children with Down syndrome.

Commonly occurring speech and language deficits

The five major areas of the deficit that are typically noted in people with Down syndrome are voice, speech sounds or articulation, fluency, prosody, and overall intelligibility (Kent & Vorperian, 2012). The presence and degree of impact on each of these areas may vary from client to client, but the majority of people with Down syndrome will exhibit deficits in at least one of these areas.

Voice Characteristics

Throughout the years, several deviant voice characteristics have been noted in individuals with Down syndrome (Kent & Vorperian, 2012). These characteristics include

a low vocal pitch, and a horse or harsh quality to their voices (Kent & Vorperian, 2012). Additional researchers searched to find an answer to why voice is altered, as well as different situations in which aberrant voicing may appear early in life. For example, the cries of babies with Down syndrome have been described as having an inconsistent quality, as well as being low in volume (Kent & Vorperian, 2012). Several researchers have come to believe that this is due to dysfunction in respiratory and laryngeal function (Kent & Vorperian, 2012). Knowing the variations in infant cries would be especially beneficial for early intervention providers, because these cries may seem especially aberrant to caregivers with other typically developing children. Thus, explaining that a deviant cry is common among children with Down syndrome may reduce concerns of parents and caregivers. The evidence that vocalizations, as early developing as cries, may be deviant, indicates that phonation may represent difficulties for this population from a very early age. Deviant behaviors may continue into childhood and adulthood as well. It is worth noting that an aberrant voice may point to a larger problem than variation in vocal quality (Kent & Vorperian, 2012). Although voice and phonation in individuals with Down syndrome have been studied using perceptual, acoustic, aerodynamic, and endoscopic assessment should be continued. These avenues may be helpful in determining how laryngeal function changes with age (Kent & Vorperian 2012). Because phonation deficits begin early in life and progress into adulthood, SLPs providing early intervention services should be aware and willing to incorporate phonation targets into therapy to prevent future deficits.

Deviant Speech Sounds

Another major area of concern for individuals with Down syndrome involves deviant speech sounds. Kent and Vorperian (2012) noted that a difference in speech patterns between typical developing children and children with Down syndrome becomes extremely evident between the ages of three and six. This is important when working in early intervention because a long term goal could be designed to close this gap early so that is not as apparent as the child enters preschool. Various sources have noted that children with Down syndrome do not make as many speech-like sounds as typically developing children (Kent & Vorperian, 2012). They also often exhibit delayed onset of canonical babbling (Kent & Vorperian, 2012). It appears that development may overlap with typically developing peers, but may be on a delay. These delays in babbling are not as self-evident as the delays children with Down syndrome exhibit regarding motor development (Kent & Vorperian, 2012). Making speech like sounds and babbling are key indicators of developing speech later in life for any child regardless of development. If these areas appear to be deficient, then therapy would be implemented for early intervention. The SLP may incorporate the parents or caregivers in therapy by encouraging them to positively reinforce any and all vocalizations. The SLP may also address vocalizations by focusing on sounds that can be visualized like “p, b, and m”. Beginning intervention on vocalizations at a young age may shorten the gap between children with Down syndrome and their typically developing peers later in life (Kent & Vorperian, 2012). Children with Down syndrome often exhibit vowel errors in speech, as well as, an abnormally high frequency of misarticulated consonants (Kent & Vorperian, 2012). Some consonants (e.g., d, t, n, and v) have proven to continue to be challenging for individuals with Down syndrome well into adulthood, even though these

sounds are usually acquired by three or four years of age in typically developing children (Kent & Vorperian, 2012). Vowel errors may be one of the first articulation targets for SLPs providing early intervention. This is because vowels increase the child's ability to vocalize and babble. It's also important because if children can minimize vowel errors, then intelligibility naturally increases and decreases frustration for the child and caregiver. Speech progress would increase the child's ability to effectively communicate with family and friends, hence increasing quality of life. In addition to articulation errors, children with Down syndrome often exhibit phonological processing patterns including final consonant deletion, difficulty acquiring liquids and nasals, and problems with stop consonants (Kent & Vorperian, 2012). Most typically developing children master these processes at a fairly young age.

Fluency

Children with Down syndrome typically show deficits in fluency. This area can pertain to any type of disfluency, including stuttering and cluttering. In a review of multiple articles focusing on speech and language characteristics of children with Down syndrome by Kent and Vorperian (2012), they found that 10- 45 % of children with Down Syndrome exhibit signs of stuttering or cluttering compared to just 1% in the typically developing population. Even if incidence falls on the low end of 10%, that population size is significantly greater than the average rate of incidence. Learning about the incidence of stuttering and cluttering in individuals with Down syndrome may increase awareness of clinicians regarding co-morbidity of disorders-it is also worth remembering that fluency disorders are not considered as a symptom of Down

syndrome, and that no two children with the syndrome will present the same characteristics.

Prosody

Prosody has not been researched as thoroughly as other areas of deficit, but reported results have been consistent across the board. Past research has indicated that individuals with Down syndrome have deficits in their ability to imitate, perceive, and spontaneously produce prosodic features (Kent & Vorperian, 2012). Deficits in prosody may lead to inability to interpret other prosodic features and misinterpret a message, as well as inability to add prosodic markers to their own expressive language. Therefore, prosody may in fact be an area of receptive and expressive language deficit for children with Down syndrome. A lack of prosodic markers in a child's expressive language may also lead to an increased rate of unintelligibility, which is the last major area of deficit in children with Down syndrome (Kent & Vorperian, 2012).

Intelligibility

According to Collins English dictionary (2010), intelligibility is the capability of being understood. When a child with Down syndrome shows a lack of intelligibility, it may be difficult for them to express their wants and needs. This can lead to frustration for both the child and the caregivers. Additionally, unintelligibility may be intensified by unfamiliar listeners and an increased length of utterance (Kent & Vorperian, 2012).

Nonverbal Communication

One additional area that is important to look at is how nonverbal communication may impact verbal communication later in life. Mundy, Kasari, Sigman & Ruskin (1995) conducted a study to determine how nonverbal communication could predict verbal

communication in children with Down syndrome and typically developing children (Mundy et al., 1995). They found that children with Down syndrome had a deficit in nonverbal communication that was tied to the development of their verbal communication later in life (Mundy et al., 1995). This study is critically important to SLPs, because we often focus solely on the verbalization of our clients, even at a young age. This study advocates the need to address nonverbal communication and its importance for the development of verbal communication later in life. Addressing nonverbal communication may be a task asked of all SLPs working in early intervention and this study reassures the SLP that there is a therapeutic need to address it as well.

Early Intervention

Children with Down syndrome should begin receiving service at a young age due to their established risk classification (Boyer, personal communication, January 2013). The speech and language deficits exhibited by children with Down syndrome may be significant in degree or impact. These deficits may also often affect them throughout their lives. It may impact their quality of life by inhibiting their ability to effectively communicate with others (Kent & Vorperian, 2012). This research review conducted by Kent and Vorperian (2012) summarizes why early intervention is so critical for children with Down syndrome. This article was drawn from correlates specifically to intelligibility, but it could be generalized to all areas of speech and language that children with Down syndrome are challenged by and why SLPs must intervene early.

Every child should be able to undergo effective therapy to minimize deficits and increase quality of communication. If we, as SLPs, can increase our client's quality of communication, we are then able to increase their quality of life (Boyer, personal

communication, January 2013). In order to do that, we would need to ask the following question: “What intervention techniques work for this population”. Now that assessment and primary deficit areas have been addressed, it would be crucial for SLPs to find evidence to support intervention techniques. The understanding of all aspects of treatment (i.e., assessment, primary deficits, and intervention techniques) will equip SLPs with the tools they need to serve this population effectively.

Assessment Tools

Parental Report

Services directed at children ages birth to three affect approximately 5-10% of the population and a delay in communication is often the first symptom for children with a developmental disability under the age of three (Boyer, personal communication, January 2013). Early intervention is critical to catching disorders early, limiting their effects, and preventing a need for intervention later in life. Early intervention is also important for maintaining typical development in other areas not displaying delays (Boyer, personal communication, January 2013). In early intervention, there are categories that help determine a child’s eligibility. One of these categories is established risk. This category says that a delay is anticipated due to an underlying diagnosis. Some examples of the established risk category include Fragile X syndrome, cerebral palsy, spina bifida and hydrocephalus. Another category is the “at risk” category. This is defined by anything that interferes with the child’s ability to interact with their environment in a normal matter which can potentially contribute to a developmental delay. Some factors contributing to the children in the “at risk” category include environmental factors (e.g., exposure to lead), biological factors (e.g., exposure to

substance abuse), poor prenatal care, pre-mature birth and low birth weight (Boyer, personal communication, January 2013). Regarding these risk categories, children with Down syndrome are also in the established risk category, so each child is eligible for early intervention from the state that they live in.

Parental reports offer clinicians the ability to see how a parent perceives their child's language. It is also a cost effective and time efficient way to gather information. The data collected is not limited to how the child performs during the formal assessment, which allows the SLP to gain additional insight into the child's communication skills (Miller, Sedey, & Milio, 1995). The validity of these types of assessment has been studied by researchers around the world. The validity of one particularly popular tool based on parental report, the MacArthur Communicative Development Inventory, was studied by Miller et al. (2013). This particular study compared the words that the parents reported in the assessment to the number of words that the child said spontaneously in a thirty minute assessment session. The authors investigated the predictive validity of the Communicative Development Inventory (CDI) component of the MacArthur Communicative Developmental Inventory. The assessment was given to both typically developing children and children with Down syndrome in order to gain an insight into how children with Down syndrome compare to their typically developing peers (Miller et al., 1995). The study revealed strong correlations between the CDI parent report and the measures of observed vocabulary for both populations. This is important because there was consistency between the language that parents observed and the language that SLPs observed. Additionally, CDI predicted vocabulary development in the same children later in life (Miller et al.,

1995). The suggested format of the parental report also allows SLPs to implement the anticipated words into their therapy sessions if the parents are able to complete it beforehand. An equally important fact is that this approach allows the parents to play an active role in the assessment process of their child, which is a crucial component to any early intervention program (Miller et al., 1995). Miller et al. (1995), reported that the CDI vocabulary checklist are an effective, flexible, and efficient way to measure language. They also reported that the CDI is a valid tool to measure vocabulary development in children with and without development disabilities (Miller et al., 1995). An additional parental report that is often used is the Language Use Inventory (LUI). In a study done by Pesco and O'Neill (2012), 348 children whose parents had completed the LUI were assessed 5 or 6 years later with a standardized, norm-referenced assessment. The authors were hoping to determine how well the LUI predicted language impairments in children later in life (Pesco & O'Neill, 2012). The parents of these children had completed the LUI when the children were between 18 to 47 months. At the time of formalized assessment, the children's mean age was 5 years and 8 months. During the assessment, the parents were interviewed to determine the child's developmental history and the child completed two language tests (Pesco & O'Neill, 2012). This study found that the LUI scores correlated significantly with language scores, especially when the LUI was completed when the child was between 24 and 47 months of age and would be an effective indicator of later language abilities. An additional study completed by O'Neill (2007), examined the reliability and validity of the LUI in young children ages 18 to 47 months. This study encompassed 177 parents, half who were the parents of children awaiting a speech and language assessment and half who were the parents of

children deemed typically developing. The parents completed the LUI twice, with a four week gap in between. This study found that the children's pragmatic language continued to grow steadily as they matured from 18 to 47 months of age. O'Neill (2007) also found that the LUI was both reliable and showed stability in distinguishing between children with typically developing language and children with a language-delay. This study found the LUI having sensitivity and specificity levels of more than 95%. The LUI appears to be an effective tool to screen children for language delays (O'Neill, 2007).

Speech and Language Samples

SLPs often utilize a speech or language sample during their assessment session. This may take place during play activities, utilizing toys that the child likes. The SLP can then transcribe the sample and get a good understanding of the child's vocabulary and how they use language. The SLP can also use the language sample to compare the child's spontaneous production to what the parents see at home (Miller et al., 1995). The use of speech and language samples can give the SLP a realistic picture of how the child communicates. The use of a sample can also help when pinpointing what aspects of communication cause the child most difficulty in being understood by adults and peers. In a study completed by Skahan, Watson, and Lof (2007), SLPs in the field reported that only 50% of the time they used speech samples to diagnose components of disorders. SLPs did report always utilizing the speech sample to determine the child's phonetic inventory and to complete a phonological analysis of the child's connected speech. It is also possible to determine a child's word and syllable shapes by analyzing a child's speech sample. (Skahan et al, 2007). The SLPs in this study reported utilizing speech samples less frequently than a single-word test. Collecting and analyzing

connected speech samples can be difficult and time consuming. The length of the sample and the depth of the analysis is often determined by the SLP (Skahan et al., 2007).

Observation

Observation of speech and language abilities leads to knowledge about the child's typical interactions, giving insight on how the child communicates and when communication may break down. Fischer (1987) analyzed how five preverbal children with Down syndrome communicated with their moms compared to five typically developing children. Each child was observed for looking and vocalization, reaching, touching, pointing, giving, showing, smiling, laughing, routines, and coordination. Fischer (1987) also examined signals that did not necessarily communicate a want or need. Examples of these signals were: object manipulation, open expression, look, touch, grasping, mouthing, throwing, locomotion, and dropping. Fischer (1987) found that mothers of children with Down syndrome tended to have a more direct style of interaction. He also found that mothers of children with Down syndrome were more responsive to their children (82.8% percent of the time compared to 60.4% of the time for mothers of typically developing children). Results showed that communication was similar between children with Down syndrome and typically developing peers, but children with Down syndrome initiated communication less often (Fischer, 1987). This study is beneficial for SLPs utilizing observation because they gain insight into how mom and baby may interact prior to doing the actual observation. This study also validates the theory that significant information can be gathered by using observation

and is therefore an appropriate tool to utilize during assessment. This suggests that SLPs may implement observation as part of their assessment protocol.

Standardized Formal Assessment

Standardized assessment is applied in order to determine areas of weakness in speech and language and pinpoint specific errors, as well to properly qualify a child with a speech or language impairment which is based upon their standard scores. The Goldman-Fristoe Test of Articulation (GFTA-2) is often utilized in order to pinpoint articulation errors. Regarding language assessments, SLPs may use the Preschool Language Scale (PLS-4), the Peabody Picture Vocabulary Test (PPVT), or the Expressive One Word Picture Vocabulary. The PLS-4 is often chosen because it provides both a receptive and expressive score and it can be administered in a short period of time (Tyler & Tolbert, 2002). The PLS-4 is often administered in the school setting and is appropriate for children 4 years of age. It has a high level of validity and can be scored in an efficient manner (Tyler & Tolbert, 2002). A study completed by Hoffman, Templin, and Rice (2012) revealed that the PPVT is often used as measure of assessing an individual's language knowledge. It is an effective way to measure language acquisition and identified language impairments (Hoffman et al., 2012). Several studies have been completed in order to confirm validity across test forms. The PPVT displays four pictures and the child is asked to point to the word that best matches a definition (Hoffman et al., 2012). Using different forms of the test (e.g., Form A vs. Form B), may make comparing the results more challenging (Hoffman et al, 2012). The study completed by Skahan et al (2007), found that SLPs most often utilize the GFTA-2, Photo Articulation Test and the Khan- Lewis Phonological Analysis (KLPA)

when assessing a child's speech production. SLPs reported liking the ability to pair the GFTA-2 and KLPA in order to obtain a larger picture of a child's abilities. They also found that SLPs frequently administer a standardized test in order to determine a child's standard score and percentile rank. SLPs reported that utilizing the standardized scores was an easy, effective way to qualify children for services.

The combination of parental report, speech and language sample, observation and formal assessments will allow the SLP to have an overall picture of the child's communication abilities, in order to make the best diagnosis and implement the most effective therapy plan. Now, we will examine some courses of treatment for individuals with Down syndrome

Treatment

Once SLPs understand the speech and language deficits, it's imperative that they chose an effective therapy plan. Therapy techniques should be implemented to target each areas of deficit, such as voice, articulation, fluency, prosody, and overall intelligibility.

Enhanced Milieu Therapy

Enhanced Milieu Therapy (EMT) is a language teaching strategy that is focused on natural communication in everyday situations (Scherer & Kaiser, 2010). It focuses on manipulating the environment to best support the student, including preferable materials and an environment that is well suited to requesting. EMT also focuses on following the child's lead, using turn taking, modeling and expanding language (Scherer & Kaiser, 2012).

A study conducted by Kaiser & Roberts (2013) focused on the effectiveness of EMT with preschool children with intellectual disabilities including Down syndrome. This study had 77 children split into 2 groups. One group was led by parents and therapists both implementing EMT, while the other group just had a therapist intervening. Both groups of children showed growth in the use of targets, length of utterances, and the number of different words used and groups displayed some generalization into home activities. Both groups also gained at least 0.5 standard deviations in the PPVT and gained twenty words in their language inventory after four months of intervention. However, the group that had parents trained in EMT showed continued growth six months and twelve months post intervention (Kaiser & Roberts, 2013)

Yoder and Warren also completed a study on EMT in pre-linguistic toddlers. This study consisted of 17 children with intellectual disabilities, including Down syndrome, and a control group of twenty children. Children received 20 minutes of therapy, 4 times a week for 6 months (Yoder & Warren, 2002). The results showed that EMT facilitated more frequent responses from the parents and in some groups of children accelerated the growth of initiated comments, requests, and the child's lexical density. However, this study revealed that accelerated growth occurred primarily in children without Down syndrome, especially in regards to requesting which actually exhibited decelerated growth. Researchers recommended not using a diagnosis as a treatment indicator alone (Yoder & Warren, 2002).

Both articles were extremely helpful in determining the effectiveness of EMT. It can be hard to generalize data across populations, which can make applying

studies to specific clients difficult. Although evidence was strong for EMT, especially when incorporating parents, a study (Kaiser & Roberts, 2013) indicated that additional research would need to be conducted to verify further evidence of EMT effectiveness and including Down syndrome. Future studies are needed to support the use of EMT for children with Down syndrome.

Combination Therapy

Integrating a combination of articulation and phonemic awareness therapies should increase the overall effectiveness of therapy. Combination therapy may in fact allow the child to make more progress in a shorter amount of time (Barnes, Roberts, & Long, 2009). Barnes et al. (2009) conducted a study in 2009 investigating the phonological accuracy and intelligibility of boys with Down syndrome compared to their peers. The study measured the number of correct consonants, phonological processes, and the percentage of intelligible words. This data was collected via spontaneous language sample, with additional information gained through parental report. The results of the study indicated that boys with Down syndrome scored lower on every measure of phonological accuracy, as well as speech intelligibility when compared to typically developing peers. The boys with Down syndrome also exhibited a higher occurrence of phonological processes than typically developing boys of the same age (Barnes et al, 2009). These results indicate the need for children with Down syndrome to receive speech therapy not only for intelligibility, but also for phoneme acquisition, retaining word shapes, and the suppression of phonological processes (Barnes et al, 2009).

Combinations of these therapy approaches should increase intelligibility as well. Two additional studies investigated combination therapies, particularly regarding speech

and phonological processes. Van Bysterveldt et al. (2006) investigated ways to enhance phonological awareness and letter knowledge in preschool age children with Down syndrome. The program focused on letter knowledge, phoneme awareness, and print concepts. This was done primarily through reading aloud, drawing the child's attention to concepts and waiting for a response. This program also incorporated parents to facilitate growth in their children. The study found that parents were good teachers. The children with Down syndrome showed growth in three of the four areas examined (i.e., letter sound knowledge, print concepts, and initial phoneme identification). In comparison, the control group only made gains in one area, letter name knowledge (Van Bysterveldt, Gillon, & Moran, 2006). A more recent study conducted by van Bysterveldt et al. (2009) looked specifically at integrating speech therapy with phonological awareness. This study focused on ten preschool with Down syndrome aged (4;4- 5;5. The study was designed so that therapy was conducted in the home and at a speech therapy center, utilizing a computer program. The children received services for twenty hours over about eighteen weeks. Each child was base-lined for specific targets unique to them, and then their own program was designed (Van Bysterveldt, Gillon, & Foster-Cohen, 2010). The results indicated that the treatment was quite effective for all participants. Sixty percent of participants showed an increase in their letter knowledge, while 90% showed an increased awareness of initial phonemes. Not all phonological awareness tasks showed as much success. The approach appeared to be most effective in remediating individual sounds, while stimulating phonological awareness and letter knowledge (Van Bysterveldt et al, 2010). A third study completed by Burgoyne, Duff, Clarke, Buckley, Snowling, & Hulme, (2012)

investigated how a combination therapy involving reading skills and language would be effective in children with Down syndrome. This study was completed with 58 students in grades 1 to 5 with Down syndrome over forty weeks. Half of the students began the intervention right away, while the other half began intervention at twenty weeks. The groups were chosen at random. The children were baselined on various areas. These areas included single word reading, letter sound knowledge, phoneme blending, non-word reading, spelling, vocabulary, taught expressive language, expressive grammar, basic knowledge, receptive grammar, and behavior. The intervention was provided by two teaching assistants who were trained on the areas to be addressed. The intervention focused on reading skills, say sight words, letter knowledge, introduction of new reading material, and new word introduction(written, spoken, and pictures). These new words were used in a word game, in oral activities, and in guided writing (Burgoyne, Duff, Clarke, Buckley, Snowling, & Hulme, 2012). This intervention method was proven to be effective (Burgoyne et al., 2012). The researchers found that the children who began intervention earlier were more successful. The children made progress in four main areas: single word reading, letter sound knowledge, phoneme blending, and taught expressive language, but intervention did not affect literacy, vocabulary or grammar. Once the waiting group began to receive intervention, they began to gain skills at the same rate as the original group. All skills that were specifically targeted showed gains at the post-test; however, skills did not generalize over for this specific population (Burgoyne et al., 2012).

A study that did not show as much promise as studies previously discussed was completed by Lemons, Mrachko, Kostewicz & Paterra, M (2012). This study focused on

15 children with Down syndrome ranging in age from five to thirteen years old. They all completed 25 sessions over a 12 week period of time. The purpose of the study was to determine the effectiveness of two commercially produced therapy programs. The researchers were wondering if these children would increase their phonological awareness, production of letter sounds, reading of high frequency words, phonetically regular words, and reading fluency (Lemons Mrachko, Kostewicz, & Paterra, et. Al., 2012). The authors believe that the children would exhibit positive outcomes in targeted skills. All intervention took place in a reading classroom or special education classroom. The two specific programs that were implemented were Road to Reading (RTR) and Road to Code (RTC). The programs included word cards, sound boards with letter cards, a small dry erase board and markers, books to read, alphabet letter cards, props for sound awareness, and a timer. Each program contained a hierarchy to be moved through. The results of the program were not clearly defined. Students gained some skills targeted, but not all of them. In general, students increased their ability to read phonetically regular words and high frequency words, but these skills did not carry over to reading fluency. The skills targeted in phonological awareness activities did not improve. More specifically, the results for the RTR program revealed that decoding interventions were effective, which allowed the students to show positive gains in reading. No improvements were seen for oral reading fluency or for identification of initial sounds. The results seen for the RTC program (phonological awareness) were not positive (Lemons et al., 2012). Improvements in letter sound knowledge were minimal and intervention was not effective for improving segmenting or blending skills (Lemons et al., 2012).

The studies completed by van Bysterveldt et al. (2012), and Burgyone et al. (2012) showed promising techniques and outcomes for intervention in children with Down syndrome. These studies exhibited positive results without many caused for concern. Conversely, the study completed by Lemons et al. (2012) showed modest gains in one specific area and it demonstrated that that skills that were specifically targeted by the intervention program did not show any gain. Additionally, both programs used by Lemons et al. (2012) were commercially produced and therefore accessible to many SLPs and families. The authors made arguments for needing a longer amount of time to achieve results, as well as about, the low level of vocalization that they participants maintained.

An additional study completed by Wright, Kaiser, Reikowsky, and Roberts (2013) studied four toddlers with Down syndrome. The authors combined Enhanced Milieu Therapy (EMT), joint attention, symbolic play, and emotional regulation to teach children spoken words and manual sign (Wright et al, 2013). The authors were investigating if this combination therapy technique would increase the children's communication abilities. This study chose naturalistic teaching strategies because it builds on the strengths that children with Down syndrome already possess. It targets functional communication skills during play and daily activities. This study also incorporated family and caregivers in order to generalize the child's knowledge outside the therapy room (Wright et al, 2013). This study chose four children with Down syndrome who were between 23 and 29 months of age. These children all had normal vision and hearing and displayed an expressive vocabulary of less than 15 words. These children also had the ability to imitate gestures and English was the primary language spoken in the

child's home (Wright et al, 2013). Intervention sessions began two times a week and lasted 20-30 minutes per session. The therapist paired 80% of verbal communication with signs and 32 signs were selected from the list of early occurring words (Wright et al, 2013). The therapist implemented strategies like following the child's lead, responding to children's communication and expanding on the child's communication attempts, using time delay and mirroring, and prompting the child when necessary in order to elicit communication attempts. The parents were observed to determine generalization of the skills to the home (Wright et al , 2013). This therapy model was proven to be effective. All 4 children in the study demonstrated an increase in their rate of signing, as well as an increase the number of different signs they could use. All children also increased their express vocabulary, but results were variable amongst the children. All children generalized their skills to the home and to a new communication partner, typically their parent. This method proved to be an effective way to expand the communication abilities of children with Down syndrome (Wright et al, 2013).

In summary, the groundwork has been laid, but more data is needed to completely support combination therapy. These studies reported in this paper were particularly helpful because all of them included participants with Down syndrome. SLPs need to choose the treatment programs based upon their client's needs. Additional research, involving larger samples and duration are needed. Many of these studies targeted the production of sounds, but did not focus on a large number of drilled productions that we often associate with "classic articulation therapy". It would be interesting to see studies including children with Down syndrome where articulation drills were incorporated with phonological awareness therapy too

Parental Involvement

Kaiser and Roberts (2013) investigated the effectiveness of a therapy program when the parents were involved. During their study, they taught 77 children with Down syndrome, autism spectrum disorder, or an unspecified global delay, a version of Enhanced Milieu Therapy. These children were randomly assigned to one of two groups. They either received therapy from parents and therapist simultaneously, or received therapy from solely a therapist (Kaiser & Roberts, 2013). These children received therapy for thirty-six total sessions and were assessed prior to therapy, immediately after therapy, six months post therapy and twelve months post therapy. Immediately following therapy, both groups demonstrated similar gains; however, when assessed six months post therapy, the children from the parent therapist group presented with longer MLU, a greater number of different words and a greater number of targeted utterances. The growth continued to be greater for the children in the parent-therapist group twelve months post therapy as well (Kaiser et al, 2013). This study supports the idea that parental involvement will increase the child's ability to communicate and increase their overall gains. With regards to this study, the parents were able to continue therapy techniques at home that were implemented in the therapy room. This allowed the child to have additional practice and to increase their overall communication ability. I have seen firsthand the positive impact parental involvement can bring. It is obvious in therapy sessions, which parents provide appropriate models and practice the targets from sessions at home. These children either progress at a quicker rate or continue progress once therapy has stopped on a regular basis.

In a study completed by Wright, Kaiser, Reikowsky, and Roberts (2013), the authors investigated the impact of parents when teaching children with Down syndrome combined naturalist sign and verbal intervention. Four children with Down syndrome participated in intervention two times a week for 20 weeks. The children were taught 32 new signs paired with vocalizations that were considered to be early occurring sounds for children. The parents or caregivers of these four children were given descriptions or pictures of the signs that were being taught, but did not receive any formal training from the therapists (Wright et al, 2013). The parents all had varying levels of signing abilities prior to the beginning of intervention. All parents demonstrated an increase in their signing ability throughout the duration of the home observation sessions. All four participants generalized their knowledge of signing and verbal expressive communication outside of the therapy room. The children began to sign in the home and signed with new partners, primarily their parents or caregiver over the course of the 20 week intervention (Wright et al, 2013). The parents played a key role in their child's success and ability to carry over their skills from the therapy room setting. Without the inclusion of parents, the results may have varied, particularly the ability of the children to generalize their new found skills to outside environments and communication partners.

Conclusion

This paper just begins to scratch the surface when studying the common deficits of Down syndrome and how they are assessed and treated. Having a general understanding of the speech and language deficits that are commonly seen in children with Down syndrome will allow the SLP to have a head start before walking into a

therapy room to meet the client. Every child, even with a similar diagnosis, is unique, but many will exhibit at least one of the common characteristics of Down syndrome. This knowledge will allow the SLP to have an assessment plan in place to maximize effectiveness, before meeting the child and his/her parent. Utilizing parental report, speech samples, observation and formal standardized assessments will help SLPs make diagnostic decisions. Every SLP will chose parental report tools and formal standardized assessments by personal preference, but there is strong evidence in the field to support tools such as the Goldman Fristoe Test of Articulation, the PLS-4 and the PPVT, among other standardized formal assessments. Once a formalized assessment is complete, the therapy approaches discussed in this paper are a good place to start when planning treatment for children with Down syndrome; however, one idea must always be remembered: each and every client is different, no matter what their diagnosis is. SLPs must be constantly collecting data and observing in order to determine the effectiveness of a therapy plan.

Lastly, motivation and reinforcement will affect the overall effectiveness of a therapy plan. Although motivation and reinforcement were not formally addressed in this paper, it is highly personal and will change client to client regardless of similar diagnoses. If a SLP can properly motivate their client, then there is a higher chance of achieving progress. Without proper motivation, the client rarely has incentive to work hard in therapy sessions. Research is continually changing and evolving; SLPs must continue to seek out the latest research to support their evidence-based practice. Research and experience make for well-rounded SLPs who can properly treat their clients.

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