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Targeting the Expressive Language of Children with Down Syndrome who are Minimally Verbal: Bridging Research and Practice

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Targeting the Expressive Language of Children with Down Syndrome who are Minimally Verbal: Bridging Research and Practice

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Abstract

Targeting the Expressive Language of Children with Down Syndrome who are Minimally Verbal: Bridging Research and Practice

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Children with Down syndrome present with an array of physical and cognitive sequelae that can hinder speech and language development. These individuals can constitute a considerable portion of a speech-language pathologist's caseload. Based on the principles of best evidence, clinicians are ethically responsible for providing the most effective treatment for their clients. The available literature focuses mainly on describing the linguistic characteristics in this population, while relatively less focus is placed on effective intervention programs. This paper investigates the available evidence regarding speech and language interventions for children with Down syndrome who are in the mild to moderate range of linguistic functioning, and provides an outlook for future research based on best evidence.

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Introduction to Down Syndrome

Down Syndrome (DS) is a genetic condition caused by the presence of an additional copy (in 95% of cases) or partial copy (in 5% of cases) of chromosome 21, called trisomy 21. How trisomy leads to the phenotype in DS remains unclear. The syndrome is the most common autosomal chromosomal abnormality causing mental retardation (MR), and individuals with DS may be a major part of a speech language pathologist's caseload. Down syndrome is associated with a range of physical and behavioral sequelae, with most individuals functioning in the mild to moderate range of MR (Abbeduto et al., 2003). Persons with DS present with general hypotonicity of facial musculature and skeletal differences that can affect the production of speech. Differences in cortical structure and nervous system development as well as hearing problems can lead to a significant delay in both receptive and expressive language skills, with expression affected to a greater degree. Recent research has provided important new information on cognitive and language development in DS (Laws & Bishop, 2010; Chapman & Hesketh, 2000; & Chapman, 1997) but research exploring treatment intervention is sparse.

Evidence-Based Practice

Speech-language pathologists are ethically bound to provide the most effective treatment for the individuals they serve. Evidence-based practice (EBP) is a framework for clinical decision-making that incorporates scientific evidence with clinical expertise and client values (ASHA, 2004). The research is replete with studies addressing the variability in linguistic functioning and developmental progress of children with DS. In contrast, the evidence for effective speech and language intervention for those who are minimally verbal is lacking. Regardless, the tenets of EBP dictate that we have a responsibility to our clients to use best practices based on the available research data, and that we need to be critical of the evidence in deciding which strategies are most effective.

The purpose of this report is to review critically the available research on the effectiveness of treatment intervention for minimally verbal DS children, and to provide recommendations to parents and clinicians. The paper will explore the use of multimodal communication, aided language stimulation, prelinguistic milieu approaches, and other interventions, as well the role of maternal responsivity in facilitating language. Research involving signing, electronic devices, picture exchange systems, and other forms of augmentative and alternative communication (AAC) with children who have speech sound disorders has contributed encouraging empirical evidence to the literature base. Due to the myriad of factors involved in choosing an augmentative and alternative mode of communication, this paper will limit the discussion of AAC to manual signing.

The first section of this report outlines the general characteristics presented by

children with DS, and the typical course of early speech and language development in comparison to typically developing children. The second section presents the highest level of evidence regarding intervention for children with DS in the early stages of language development. Finally, the implications and directions for future research such as multimodal communication are examined.

Diagnosis and Characteristics of Down Syndrome

The Center for Disease Control and Prevention estimates the prevalence of Down syndrome (DS) in the United States at about 12 per 10,000 live births ("Prevalence of Down syndrome," 2009). A physician may suspect a diagnosis of DS in a newborn based on physical features present at birth, such as simian crease (a single line across the palm), sandal gap (a slight interspace between the first and second toe), epicanthic folds (a fold of skin on the inner side of the eye), hypotonia (low muscle tone), upslanting palpebral fissures (separation between the upper and lower eyelids), and a protruding tongue (Devlin & Morrison, 2004); but cytogenic analysis (microscopic analysis of the chromosomes) is necessary for a definitive diagnosis. Physical expression of the disorder varies greatly, with some traits occurring in every individual and some characteristics present to different degrees. Cognitive impairment is present in all cases, but differs in severity, and involves a disproportionate deficit in language development as opposed to social intelligence.

Roberts, Chapman, Martin, and Moskowitz (2008) described the anatomical abnormalities associated with DS. The condition affects the development of nearly every organ system, causing difficulties throughout the lifespan. Congenital heart defects are present in about 40% of cases. Gastrointestinal defects are common and can cause reflux, which can interfere with feeding and swallowing. Facial malformations lead to problems in the middle ear such as narrowing of the eustachain tubes and sinus cavities, resulting in frequent middle-ear infections, and often, subsequent hearing loss. Persistent hearing loss

due to otitis media (frequent ear infections) is common and may interfere with language learning, especially comprehension of vocabulary and grammatical morphology. Approximately two-thirds of children with DS present with hearing loss (conductive, sensorineural, or both). Anatomical differences in the central and peripheral nervous system, reduced brain size and weight, fewer cortical neurons, and delayed myelination of neurons are among some of the neurological differences present in DS. Low muscle tone, endocrine disorders, sleep apnea, seizure disorder, dental problems, and cataracts are other common sequelae of DS. Adults with DS also are prone to developing mental illnesses such as depression and obsessive-compulsive disorder. Alzheimer's Dementia is present in 75% of adults with DS who are over 60 years old (Roberts, Chapman, & Warren, 2008).

PRELINGUISTIC DEVELOPMENT

Research has revealed little difference in the prelinguistic skills of DS compared to typically developing (TD) children (Buckley, 1999). However, due to the importance of these skills in laying the groundwork for later language learning, a more detailed investigation of these skills is warranted. Prelinguistic skills include the vocalizations and pragmatics children use before they have a linguistic system in place for acquiring speech. This section will explore the roles of gesture, sign language, and joint attention in facilitating these skills in children with DS. Sterling and Warren (2008) classify children as prelinguistic if they use fewer than 10 non-imitative words or signs, understand fewer than 75 words receptively, and make fewer than two intentional communicative acts per

minute. Similar to children who are typically developing (TD), children with DS possess an inventory of nonverbal communication skills such as looking, smiling, laughing, pointing, showing, giving, and communicative routines. However, Chapman (1997) found that these behaviors in DS are more likely to be contingent on responses from mothers and less likely to be paired with vocalizations or words than they are in TD children. Babbling may be an important prerequisite to acquisition of speech and language. Children with DS often begin canonical babbling two months later than TD infants, likely due to the hypotonicity and delay in motor development (Stoel-Gammon, 2001).

An area of relative strength in the prelinguistic development of infants with DS is pragmatics, especially in the use of gesture. The use of intentional gestures may reflect cognitive processes such as coordinated attention, representational thought, and the ability to plan action sequences (Capone & McGregor, 2004). Most babies with Down syndrome begin to imitate gestures such as waving and pointing at approximately 18 months (a few months later than their TD peers), but their repertoire of gestures is significantly larger than that of TD children when matched for word comprehension on the MacArthur Communicative Development Inventory for Infants (Fenson et al., 1991; Buckley, 1999; Caselli et al., 1998).

Gestures

Gesture use capitalizes on the relative visual strengths in DS. Chan and Iacano (2001) followed three children with DS for five months beginning when they were 17 to

19 months old. They discovered a preference for gesture use among these children, as well as the production of gesture for a variety of functions, including conventional (e.g., bye-bye), deictic (e.g., pointing), enactive play scheme, expressive (bodily movements to express emotion), and symbolic types (e.g., play scheme produced with a substitute object). However, Mundy, Sigman, Kasari, and Yirmiya (1988) found that use of gesture to request an object was lower in comparison to TD peers. Use of gesture also serves as a valuable scaffold for children with DS. Wang, Bernas, and Eberhard (2001) observed 40 inclusion students with DS and a mean age of 7.5 during classroom activities. They found that when the teachers' scaffolding behaviors (providing clues, demonstrating, encouraging, etc.) were paired with gestures, the DS students were more responsive to the teacher's directives, focused longer on the tasks, and were more likely to complete the tasks successfully than without the addition of gestures.

Sign Language

While gestures refer to objects and events present in the child's immediate environment, signs and other forms of AAC can be utilized to represent non-concrete referents, such as abstract information relating to emotions and ideas. Kumin, Councill, and Goodman (1999) suggest that the difficulty in expressive language is related to the oral motor and motor planning difficulties that many children with DS exhibit, and that sign can be used effectively to alleviate these difficulties. Children with DS have difficulties with short-term auditory processing (especially when compounded with hearing loss) that affect their ability to assimilate verbally presented information. Due to

the visual advantage of the manual modality and the importance of a preverbal foundation for language learning, researchers have explored how sign can be effectively used in early intervention to alleviate these difficulties (Wang, Bernas, & Eberhard, 2001; Kay-Raining Bird, Gaskell, Babineau, & Macdonald, 2000; Powell & Clibbens, 1994). Studies addressing the use of sign language in this population will be considered next.

Joint Attention

Joint attention reflects another pragmatic function that is critical to the foundation of early language development. Joint attention refers to an infant's ability to share an experience regarding an object of attention by engaging a communicative partner by following eye gaze, pointing, gesturing, etc. and has proven to greatly influence later language development. Joint attention allows the infant to interact with the environment, imitate others, and regulate emotions, at a time when a partner's language input has a critical impact on the infant's assimilation of information. Although children with DS typically have excellent social skills, there are some delays in joint attention, especially in regard to eye contact. Establishment of reciprocal eye contact in DS is delayed, and is sustained for longer than is typically observed in TD peers (Berger & Cunningham, 1981). Additionally, Harris, Kasari, and Sigman (1996) found that infants with DS have difficulty maintaining attention on a toy or activity, as well as switching their attention between stimuli. The presence of joint attention has important implications for parental responsivity. Yoder and Munson (1994) found that mothers of TD infants responded to their babies' communicative attempts more often when the acts included coordinated

attention than when they did not. Intentional communication attempts such as requesting provide an important precursor to spoken language.

EXPRESSIVE/ RECEPTIVE LANGUAGE

The most salient differences between TD children and those with DS begin to emerge with the transition from prelinguistic skills to speech. The average age for the first spoken words in DS is approximately 18 months (6-7 months later than TD peers), acquisition of vocabulary is slower than in their TD peers, and speech is likely to be less intelligible. Typically developing children begin combining words at approximately 19-24 months of age. Out of a group of 130 children with DS, Kumin, Councill, and Goodman (1999) found that the majority were not combining words by age two, but 69% had begun to express two-word combinations by age three. The results from the study also indicated a large variability in vocabulary growth between the ages of one and five years.

Expressive language in children with DS typically is significantly delayed relative to TD children matched on mental age, often resulting in wide expressive-receptive and expressive-cognitive gaps (Kay-Raining Bird, Gaskell, Babineau, & Macdonald, 2000). The gap between language production and comprehension in children with DS widens as they progress through childhood. A particular area of concern as expressive language develops in DS is productive syntax, which is characterized by frequent omission of function words and variability in omission of bound morphemes. These deficits in productive syntax can impede speech intelligibility. Auditory short-term memory is an

area of specific difficulty, which can affect many areas of language development, and is not aided by reducing environmental distractions (Chapman, 1997).

Individuals with DS present with a wide variety of communicative skills. A well-researched DS behavioral phenotype provides information on strengths and weaknesses that can directly inform treatment. Effective speech and language interventions ideally should begin in the prelinguistic stage of development and provide support for any hearing loss present, initiation of communicative requesting, and sufficient amounts of linguistic input tailored to the child's level of development. Other disorders that evince similar behavioral profiles, such as Williams syndrome and fragile X syndrome may be helpful to reference in guiding assessment and treatment. Following is an analysis of empirically based research that addresses intervention in DS.

Language Intervention in Down Syndrome

Children with DS and other developmental disabilities often remain in the prelinguistic and early linguistic stages of development longer then their TD counterparts, prompting the development of several intervention approaches aimed at facilitating early communicative behaviors. The interventions reviewed include the best evidence for facilitating early speech and language skills of children with DS. These approaches represent varying theoretical ideologies and were chosen to reflect their prevalence and effectiveness.

SIGN LANGUAGE

Research provides strong support for the notion that sign encourages speech and language development, despite the commonly held belief of parents and caregivers that it inhibits speech (Grove & Walker, 1990). Many children with DS will be able to learn specific signs to express their message when expressive language is lacking, at approximately age two to four years (Buckley 1999). Sign and gesture can diminish verbal processing deficits by providing concrete visual information, and can function as modeling, acting, facilitating, and getting attention. Signs also are advantageous in their portability and comprehensibility. Still, the literature is sparse on the usefulness of sign with DS infants compared to other modalities.

There are specific advantages to signing with children with DS besides the benefit of an additional modality, which circumvents the verbal difficulties in understanding and

expressing needs and ideas. Since children with DS often demonstrate difficulty shifting and maintaining attention, it may be necessary to utilize tactics to ensure sustained attention such that the child will profit from the communicative input. Clibbens, Powell, and Atkinson (2002) offer some suggestions for achieving joint attention: signing within the child's pre-existing focus of attention, moving the sign to the child's face (for signs typically located near the signer's face), and manipulating the child's focus of attention (such as moving a desired object into the child's line of vision).

In 1988-1993, speech therapists at the Helsinki City Social Services Department carried out The Early Signing Project: Enhancing the Development of Early Communication and Language Skills of Children with Down Syndrome (Launonen, 1996). The researchers explored how intervention combining sign language with speech affected the communication skills of the participants, during intervention and two years after the study was completed. They followed 29 children with DS between the ages of six months and three years old. The performance of the group was later compared to a similarly matched control group that received traditional speech therapy with no signing. Intervention was provided over the course of two and a half years, and involved the speech therapist mainly in a consultative role to the parents, who were instructed to train their own children through daily sign language training sessions. Parents were encouraged to speak normally when signing and to sign target 'key words' in the spoken utterance, which were chosen based on the child's skill level. Signs were incorporated into songs, games, and interactive and challenging activities during intervention.

The children were assessed every six months from the ages of one to three, and

follow-up evaluations were conducted when the children were four and five years old using The Portage Assessment Scale (Tiilikka & Hautamäki, 1986). This assessment is used to evaluate skills in five areas, with and without the use of signs: social, language, self-help, cognitive, and motor. Although the *Portage* scale is not standardized, Arvio, Hantamäki, and Tiilikka (1993) found its reliability and validity to be sufficient based on studies of intellectually impaired populations in Finland. The results revealed a significant difference between the experimental and control groups at age three (after the intervention was complete), which was most evident in the areas of language with the aid of sign, and cognitive development with and without sign usage. Although the gap between the groups closed somewhat at ages four and five, the difference remained significant in language and cognitive skills both with and without sign at the two-year follow-up. Individual differences such as preference for signing emerged, as some children used sign as the dominant modality for less than a year, and others used primarily sign at least until age five. The necessity for joint attention between parent and child during interactions, as well as the likelihood that parents spoke more slowly, used shorter utterances, and emphasized key words more when signing likely contributed to higher scores in this study. Quality of parent-child interactions is crucial in the development of speech and language skills, and can be manipulated to provide greater learning opportunities.

PRELINGUISTIC MILIEU TEACHING / RESPONSIVE TEACHING

Perhaps the most well researched technique for facilitating early speech sound

development in children with developmental delays is the milieu teaching approach (Warren, Yoder, Gazdag, Kim, & Jones, 1993), which allows for modification based on the child's level of functioning. In milieu teaching, children are encouraged to communicate through the use of various indirect techniques such as environmental arrangement, following the child's lead, physical prompting, and utilizing verbal requesting. The probability of generalization is hypothesized to be greater due to the embedding of teaching experiences in natural environments and activities, especially important given that children with developmental delays often have difficulty generalizing newly acquired communication skills. Communicative targets are chosen slightly in advance of the child's developmental skill to ensure appropriate scaffolding. In children who exhibit little or no use of conventional words and signs, prelinguistic milieu teaching can be employed to target nonverbal communication acts.

Responsive teaching (RT) commonly is used with the prelinguistic milieu approach, and involves teaching the parents techniques to facilitate the language growth and development of children from birth to six years old. Behaviors such as social play, imitation, problem-solving, and joint attention are targeted due to their recognized foundation for developmental learning. The approach is designed to promote the child's cognitive, communicative, and social-emotional well-being (Mahoney, Perales, Wiggers, & Herman, 2006), and is based on the assumption that the more engaged a child is, the more he/she will learn from the communicative environment. High levels of maternal responsivity are related to increases in child's pivotal behaviors and developmental and social well-being.

Results from a seminal study by Mahoney, Finger, and Powell (1985) revealed that maternal responsiveness accounted for almost 25% of the variability in children's rate of development. Responsiveness includes verbally and physically supporting the behavior that is initiated by the child, as measured by the Bayley Scales of Mental Development (Bayley, 1969). The study included 60 mother/child pairs in which 90% of the children had DS. (The remaining children had William's syndrome and hydrocephaly.) The children with the highest rate of development were those whose mothers exhibited high responsiveness and were oriented to their child's interests, and low in behaviors that involved teaching the child and directing their attention. In opposition to directive instructional approaches such as modeling, shaping, elicted imitation, prompting, and extrinsic reinforcement that focus on partner-directed communication, directive instructional procedures assume that children with developmental delays will catch up, and must learn higher level developmental skills since they are unlikely to engage in these behaviors on their own. Although RT may not be as effective as more directive approaches at teaching higher level language skills, it may be more effective in encouraging the learning processes that are pivotal for developmental learning.

The RT curriculum includes 66 Responsive Teaching strategies and 16 Pivotal Behaviors that are used as developmental intervention objectives. The RT strategies are based on the idea of "active learning," and include the following: a) reciprocity – the "give and take" during interactions, b) contingency – encouraging interactions that have an immediate and direct relationship to the child's behavior, c) shared control –

facilitating and expanding the child's actions and attempts at initiation, d) affect – expressive and warm interactions with the child, and e) match – interactions and requests that are appropriate for the child's developmental level, interests, and temperament. As parents use these strategies and see their child's engagement and participation increase, theoretically, their motivation to continue implementing the strategies increases, resulting in a reciprocal relationship between parent's instinctual responsivity and the child's level of engagement.

Pivotal Behaviors address the three developmental domains of cognition, communicative and social functioning, and include practice, joint attention, trust, empathy, vocalization, and social play, among others. These behaviors are drawn from contemporary theory and research in child development. The Pivotal Behaviors can be assessed periodically using a rating scale. Interventionists are invited to choose among the behaviors to target, ensuring that the target objectives are tailored to fit the child's needs. RT sessions usually are conducted weekly, either individually with parents and their children in the home or clinic setting (Mahoney et al., 2006). The tenets of RT can be incorporated easily into daily routines such as feeding, bathing, dressing, shopping, and other communicative exchanges.

Warren, Yoder, Gazdag, Kim, and Jones (1993) focused on communicating, requesting, and vocal imitation as functions of a pragmatic foundation for both prelinguistic and linguistic communication. In the first experiment, they measured the prelinguistic requests, unprompted requests, and unprompted comments of a 20-month-old-boy with Down syndrome named Gary. The activities during intervention utilized

music play, dress-up, farm, cars, ball, and water play. The three behaviors mentioned above were taught using the tenets of milieu teaching and were measured in behavior per minute. This data then was compared to a normative database established by Wetherby, Cain, Yoncias, and Walker (1988). The results indicated that the procedures were effective in increasing all three behaviors in the treatment setting with the trainer. However, since no data were collected to assess generalization effects, the researchers conducted a second experiment in which they sought to replicate the within-treatment effects as well as examine whether these effects generalized across teachers and classroom settings. Additionally, they evaluated whether there were changes in the behaviors of the classroom teachers in response to changes in the participants.

The four participants in the second experiment were children of varying etiologies (one child had DS) between the ages of 23 and 30 months of age. The children received intervention targeting prelinguistic requesting, since none of children demonstrated this behavior during baseline assessment. A multiple baseline design was utilized to examine the intervention effects. The results of this experiment indicated that all four participants made substantial gains in rates of intentional communicative acts per minute, rates of requesting, and rates of commenting during the intervention. To assess whether the children's behaviors generalized to other settings, the researchers assessed the subjects' classroom teachers, who demonstrated almost no requests for communication and turn taking behaviors during baseline. The teachers exhibited increases in both areas subsequent to intervention with the children, a result that is particularly promising since the teachers had no knowledge of the children's intervention goals, suggesting that their

changes in behavior were most likely a result of the subjects' interactive behaviors in the generalization setting. Evidence for a causal effect of a child on the teacher's use of behaviors that may facilitate subsequent communicative development lends encouraging support to the transactional effect.

Yoder, Warren, Kim and Gazdag (1994) investigated whether teachers and mothers who were blind to the purposes of the study linguistically mapped intentional communication more often than preintentional communication. The term linguistic mapping refers to the adult's verbal acknowledgment of what the child is communicating nonverbally (Warren et al., 1993) and is important in facilitating development of vocabulary, due to the saliency of the referent to which the child is attending. The investigators were motivated by the transactional model of development, which rests on the assumption that children's behavior affects adults in ways that encourage further language development. The transactional effect occurs when the child's response to the adult's linguistic mapping results in the increased likelihood that the adults will engage in this behavior in the future. They suggested that transactional effects are more likely to occur when intentional communication is linguistically mapped (rather than preintentional communication). Intentional communication requires joint attention between the object and the communicative partners, or a conventional or symbolic communicative form.

The study utilized a multiple-baseline design with four subjects with mild to moderate MR, ranging from 21-27 months. Two children were diagnosed as DS; the others were labeled developmentally delayed. The children scored very low on the

Communication and Symbolic Behavior Scales (CSBS; Wetherby & Prizant, 1993) compared to their chronological age. The children's mothers ranged in age from 24-45 years old. Three hypotheses were tested. First, they predicted that modified milieu teaching would increase the intentional communicative acts in project staff and mothers. Second, they predicted that mothers would linguistically map more of their children's communicative acts during intervention than in the baseline phase, and third, both teachers and mothers would be more likely to map intentional communicative acts over preintentional acts. The baseline measurement period was used to determine target selection and pre-treatment communication levels.

Two members of the project staff who were experienced using milieu teaching approaches implemented the intervention. Teaching was carried out four days a week in 25-minute sessions, and techniques included employing environmental arrangement, utilizing social routines, direct prompting, and following the child's attentional lead. Ten-minute sessions with the mothers were conducted during baseline and intervention phases to assess generalization across interactions, setting, materials, and interaction styles. Generalization to the educational setting was not possible due to the unexpected change in teachers during the intervention phase. The children's behaviors that were coded during data collection included: linguistic mapping, requests for communication, requesting, other intentional communication, preintentional signals (such as request for object without joint attention). Adult behaviors were coded for linguistic mapping and requests for child communication. Interobserver agreement for intentional requesting was 90.9%.

The results indicated that all four children exhibited an increase in number of intentional requests. For two of these participants, the number of requests was similar during interactions with staff members and mothers at the end of the intervention, indicating generalization to different communicative partners. Proportion of communicative acts (intentional and preintentional) also increased significantly for all subjects during intervention. Teachers and mothers linguistically mapped intentional communicative acts more than preintentional acts, confirming the hypothesis. During generalization, all four mothers showed an increase in linguistic mapping of communicative acts from .55 acts per 10-minute baseline session to 3.8 per 10-minute intervention session, lending further support to the transactional effect.

These results indicate robust support for the assertion that a modified milieu teaching approach is an effective method for facilitating intentional, prelinguistic requesting in young children with developmental delays in their interactions with mothers, extending the findings in interactions with teachers explored by Warren et al. (1993). Given that these initial explorations of the effects of PMT focused on a small sample size and utilized single subject, multiple-baseline designs, subsequent researchers (Warren, Fey, Finestack, Brady, Bredin-Oja, & Fleming, 2008) sought to extend these findings with the inclusion of a control group and a larger sample size, as well as longitudinal examination of effects.

Mahoney and Perales (2005) evaluated 50 mother-child pairs who were involved in the development of the RT curriculum. The children's ages ranged from 12 to 54 months, and they had significant delays in cognition and/or communication. An average

of 33 one-hour sessions were conducted over the course of a year. The researchers assessed the children's cognitive and language development and presence of pivotal behaviors, and mothers' style of interaction. The results indicated an increase in the mothers' levels of responsiveness and affect, and all 50 children demonstrated an increase in the seven pivotal behaviors measured by the Child Behavior Rating Scale (Mahoney & Wheeden, 1998), including attention, persistence, involvement, cooperation, initiation, joint attention, and affect. While no control group was included in the study, the significance of the improvements was greater than those reported by Guralnick (1997) for most other early intervention procedures.

Fey, Warren, Brady, Finestock, Bedin-Oja, and Fairchild, et al. (2006) found that responsive education/ prelinguistic milieu teaching (RE/PMT) produced no increases in contingent, verbal responses in parents of children with DS (although these recoding behaviors were high at the start of the study). The study examined between group differences on the effects of RE/PMT on rate of intentional acts (imperative and declarative) in a randomized, controlled trial. Fifty-one children between the ages of 24 and 33 months were randomly assigned to a RE/PMT or no-treatment group. Thirteen children in each group had DS. (All children had mild to moderate mental retardation.) The parents in the RE/PMT group received eight one-hour sessions of RE, conducted by speech language pathologists over a six month period. The children participated in PMT interventions 3.3 days per week in 20-minute sessions over six months. Three speech therapists were blind to group assignment during a pre-test that assessed the children pre-test and post-intervention using the CSBS (Wetherby & Prizant, 1993). The authors

monitored three variables: children's rate of imperative acts, declarative acts, and intentional acts. For the parents, the researchers were interested in percentage of child acts that were linguistically mapped or recast by the parent during a parent-child interaction component, as well as parental stress.

Although the results were not significant for the effects of RE/PMT intervention with parents of children with DS, they found an increase in children's rate of intentional (imperative and declarative) acts in the RE/PMT group compared to the no-treatment group, providing encouraging support for this method for children with language delays overall. However, within the RE/PMT group, the 13 children with DS showed no significant difference in scores compared to the children with other developmental disabilities (non-DS group). There were no effects of the intervention on parental stress. The investigators concluded that RE/PMT procedures could be used with at least some children with DS with no signs of adverse effects.

Warren et al. (2008) extended the study by following the same group of children at six and 12 months post-intervention to determine the long-term effects of RE/PMT on children's communication and language development, as well as the effects on parental responsivity. The authors utilized a randomized, controlled design that mirrored the 2006 study. The children did not receive any intervention services provided by the project between the end of the RE/PMT intervention and six months later, but were enrolled in school-based intervention, wherein services were limited and varied greatly from child to child. At the six-month mark after intervention was complete, the authors instituted a booster RE/PMT intervention program, which was limited in duration and intensity, to

ensure some degree of control over services received between six and twelve months post-intervention. They hypothesized that the children who had received RE/PMT would perform significantly better than children who had not received RE/PMT at both later time points. After combining three language sampling contexts (free play parent-child interaction, and two relatively unstructured child-examiner samples), the authors discovered no evidence that the main effect observed by Fey et al. (2006) had been maintained after six months or generalized to other measures of language development, such as lexical density.

FOCUSED STIMULATION

Another method of parent-centered treatment involves the specification of targets taught to the child. Focused stimulation centers on training parents to use interactive techniques to target specific words, encouraging vocabulary acquisition in their children. This technique has resulted in positive outcomes on vocabulary acquisition in kids with delayed language skills but normal cognition. Girolametto, Weitzman, and Clements-Baartman (1998) investigated whether these results could be extended to children with DS. Like PMT, the techniques used in focused stimulation are based on social interactionist theory, but include frequent, highly concentrated presentations of specific language targets while following the child's lead and attending to their interests. The investigators sought to examine parental changes in language modeling behavior subsequent to focused stimulation intervention, as well as the related changes in their child's vocabulary development.

Twelve children with DS (between 29 and 46 months of age) and their mothers participated in the study. The children were limited to communication using single words and/or signs. The study utilized a pretest-posttest control design with random assignment to either an immediate treatment or delayed treatment group, although the "no treatment" group still received language intervention services during the experimental phase through their preschool. The mothers were instructed in focused stimulation using the Hanen Program (Manolson, 1992), which involves the parents in the pivotal role as language teacher, alongside the coaching and feedback of a Hanen-certified speech language pathologist. Hanen techniques involve following the child's lead by a) observing, waiting, and listening, b) being at the child's physical level, and c) joining in the child's play. The mothers chose 10 words from a list of 20 that they thought their child would be most likely to learn. During intervention, the speech-language pathologists provided feedback during four home visits and videotaped parent-child interactions, over a 13-week period. The SLPs encouraged mothers to facilitate language using imitation, repetition, interpretation, labeling, and asking for clarification. The researchers measured results four months after the completion of the intervention.

The results indicated that the mothers successfully modeled different words and used focused stimulation techniques effectively compared to the mothers in the control group. The results did not, however, reveal differences between the groups on a measure of overall vocabulary size after intervention, as measured by the *MacArthur - Bates Communicative Development Inventory* (Fenson, Dale, Reznick, Thal, Bates, & Hartung, et al., 1993). The experimental group showed significant gains in use of target words

(almost twice as many target words were used) compared to the control group. This finding highlights the difficulty in generalization of word acquisition to untrained words. Nonetheless, the study revealed that interactive focused stimulation is a viable method of intervention with children who are at the one-word level and have concomitant cognitive and comprehension deficits.

DISCRETE TRIAL INSTRUCTION

Discrete trial instruction is another method of training specific targets. Feely and Jones (2008) explored the effectiveness of this intervention with a three year, nine-month-old boy with Down syndrome named Max. Discrete trial teaching (DTT) is controversial due to its use of behaviorist principles of teacher-directed trials of stimulus and response, and is often used with children on the autism spectrum. The intense intervention program in this study featured multiple opportunities to produce three functional targets selected by Max's parents ("Bless you," "Uh-oh," and "Coming" in response to the "come here" gesture), which were presented in close temporal proximity. Max achieved mastery of all three target spontaneous responses, which generalized to his integrated classroom and other areas in the school. This study demonstrated the effectiveness and merit of teaching specific responses, and the researchers hypothesized that Max was able to generalize these responses due to his ability to utilize natural contingencies of reinforcement across meaningful stimuli. Furthermore, the methods used during the intervention were explicitly stated in the study, providing a useful link between effective research and clinical practice.

GRAMMATICAL RECAST INTERVENTION

Children with DS who have progressed past the level of prelinguistic development may be using speech to communicate, but often present with deficits in speech comprehensibility, particularly due to a lack of grammatical complexity combined with the motor constraints inherent in this population. The difficulties with grammatical acquisition observed in children with DS are the focus of grammatical recast intervention, in which adults add accurate grammatical information to a child's platform (original) utterance. Similarly, speech recasts target the incorrect phonemic information of the child's original utterance. These techniques capitalize on the proximity and semantic overlap of the child's immediately preceding utterance, making linguistic information more salient and likely to be acquired (Nelson, 1989). Speech intervention in children with DS often targets production using oral motor goals and drill; however, such decontextualized training may result in little generalization in children with mental retardation. Previous studies (Yoder, Spruytenburg, Edwards, & Davies, 1995; Camarata, 1993; Camarata, Champion, Koegel, Koegel, Smith, & Ben-Tal, 1997) have utilized speech recasts and overall speech comprehensibility to produce improvements in intelligibility of children with cognitive delays and speech and language deficits, but never in the same treatment session. Smith and Camarata (1999) found that children with speech and language disorders demonstrated faster responses to speech recasts than to imitation training.

Camarata, Yoder, and Camarata (2006) combined the two types of recasts using the Broad Target Recast (BTR) approach, which delivers recast on almost all relevant

child utterances, distinguishing it from other recasting treatment methods. A previous study by Yoder, Camarata, and Gardner (2005) using BTR with children who had co-morbid speech and language impairments showed promising support for this type of intervention. The investigators sought to test the effects of BTR on the speech comprehensibility and utterance length of children with DS. They hypothesized that applying BTR in a naturalistic intervention setting would facilitate the grammatical speech development of children with DS. They used a multiple baseline, multi-probe design with six children who received intervention twice weekly for six months. The participant's ages ranged from four years, three months to seven years, four months. The two dependent variables of speech comprehensibility and MLU (mean length of utterance) growth were measured during generalization conversational samples. All six participants had MLU's of above 1.0 and demonstrated at least 20 utterances that were at least partially comprehensible in a 20-minute conversational sample. Interobserver agreement for speech comprehensibility was .72, and .88 for MLU.

The results of the study indicated an increase in speech comprehensibility in four of the six children, and an increase in sentence length in five of the six children after recast intervention. Although the findings cannot readily be interpreted as causation (as the variables measured were subject to maturational influences), the multiple baseline design allows a degree of confidence in the intervention effect in two children whose baseline results were stable over three to five sessions. Children with DS are less likely to benefit from traditional articulation therapy or oral motor training due to their differences in oral anatomy, and generalization is less likely to occur in decontextualized settings

such as a clinic environment (DeThorne et al., 2009).

Conclusion

Individuals with Down syndrome constitute a heterogeneous population who possess a wide variation of interrelated characteristics, often resulting in language delay and speech difficulty. This population presents the difficult task of choosing developmentally appropriate goals that are consistent with the current knowledge base concerning diagnosis and common behavioral phenotype. Although research addressing the typical speech and language profile of children with DS is abundant, the intervention efficacy research is less accessible and is further divided according to varying theoretical frameworks.

The transition from prelinguistic to linguistic communication is particularly problematic for many children with DS. A multitude of factors must be considered when deciding which treatment approach to use in this population, such as developmental appropriateness, specific goals to target within this level, access to resources such as therapy (intense vs. moderate), limitations unique to the child (i.e., concomitant health issues such as hearing loss or presence of an additional disorder such as autism), and philosophical beliefs about language learning (such as whether it is suitable to teach sign, or how early to begin intervention). A common problem in research on prelinguistic language intervention is the difficulty engendered in experimentally controlling for the effects of maturation. Individual differences in treatment response should be considered as well as the pre-treatment factors that may predict these differences.

The studies reviewed represent the current research on children with DS, the preponderance of which is focused on child-centered, parent-implemented approaches. Although these approaches have resulted in differential effects, milieu-teaching approaches do show promise for disordered populations; however, further research is necessary to examine the longitudinal effects of these methods on children with DS. Milieu teaching takes the child's developmental level into account and has resulted in a high level of generalization to untrained contexts, indicating a high level of ecological validity (Yoder et al., 1994). The techniques can be incorporated easily within daily routines.

The topic of multimodal communication has received relatively little attention in the development of programs for children with DS, although research indicates an advantage of visuospatial processing over verbal information (Byrne, Buckley, MacDonald, & Bird, 1995; Launonen, 1996). Pueschel, Gallagher, Zartler and Pezzullo (1987) discovered support for a greater susceptibility of the auditory modality to distraction in DS. Capitalizing on relative visuo-spatial and visuo-motor strengths and reducing attentional demands could prove a promising avenue, especially when combined with other evidence-based approaches such as milieu teaching. Indeed, Wang, Bernas, and Eberhard (2001) demonstrated that children with Down syndrome respond better to verbal scaffolding when paired with gestures than speech-only scaffolds. There is substantial evidence for the effectiveness of sign language in facilitating language in children with DS that should be further explored.

One of the most glaring obstacles in compiling efficacy data is the variation in

communicative acts targeted in the research. Researching effective communication practices necessitates specificity in defining speech acts, and for whom they are most appropriate. There is no ready-made program designed for any group of individuals, in part due to the complicated nature of communication coupled to the myriad of characteristics associated with populations that often have deficits in expressive and receptive language. As a result of the deficiency of research in many areas of communication disorders, clinicians have come to rely on problem solving based on trial and error when evidence is not available (Kamhi, 2006).

Although 98.5% of speech and language therapists reported that research is important for professional practice, there are significant hurdles in implementing the best current evidence (Metcalfe, Lewin, Wisher, Perry, Bannigan, & Moffet, 2001). The most significant barrier to implementing EBP is the clinician's lack of time for reading and implementing research (Newman, Papadopoulos, & Sigsworth, 1998; Metcalfe et al., 2001). Other barriers include difficulty understanding statistical analyses presented in research papers, an absence of meaningful results that relate to clinical practice, lack of access to current evidence, and difficulty translating results from studies into practice (O'Connor & Pettigrew, 2009). The barriers identified highlight the need for wider accessibility of best evidence and clear and concise information, to counteract the effects of limited time to examine research. Expert opinion and patient's preferences and life circumstances should be integrated with best evidence to provide a complete picture of the best course of action for the client.

Ultimately, the variability inherent in the population dictates the need for

individualized intervention, which may include different combinations of treatment approaches for each child, as well as identification of specific strengths characteristic of DS in informing treatment. Many approaches overlap in use of techniques for facilitating language, allowing the clinician to adopt an eclectic and individualized style of intervention. Clinicians bear the responsibility of carefully examining the evidence base, and collaborating with the parents in providing the client with services that target functional communication.

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