

AN EVALUATION OF TWO
INTERVENTIONS ON THE
PHONETIC REPERTOIRE OF
CHILDREN WITH MULTIPLE DISABILITIES

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Abstract

Children who have multiple disabilities often have complex communicational needs (Crickmay 1966; Orelove & Sobsey, 1996; Van Riper & Erickson, 1996; Workinger 2005). To augment or supplement these children's communication skills some form of alternative and augmentative communication (AAC) may be provided (Beukelman & Mirenda, 2005; Downing, 1996; Orelove & Sobsey, 1996; Stephenson & Dowrick, 2005). However it has been found that parents fear AAC will prevent focus on verbal output which is the preferred way of communication (Allaire et al 1991; Beukelman & Mirenda, 2005; Schlosser, 2003; Stephenson & Dowrick, 2005). This study investigated the impact of a combined therapy approach on the phonetic repertoire of children with multiple disabilities. In addition, changes in communication intent were also explored. Each child received intervention across four, 20-30 minute sessions per week for six weeks. Results show that all of the children made improvements, however not all changes were significant. Clinical implications of the study include the notion that working on traditional therapy techniques can improve the speech and language of children who have multiple disabilities and there is a need to look further at traditional therapies and incorporate AAC into these.

Introduction

1.1 Children with multiple disabilities

Children with multiple disabilities present with impairments which range across sensory, physical and cognitive domains (Mednick, 2000). Many of these children are diagnosed with conditions such as Cerebral Palsy (CP), Epilepsy, Cortical Dysplasia (CD), visual impairment, and intellectual disabilities (ID). Often the children present with a combination of disabilities for example, CP and visual impairment. These disabilities impact not only on their physical and communication skills but also activities of daily living.

Children with severe multiple disabilities often experience the developmental process differently from children with typical development. This can include difficulties with head control, particularly with CP, which may in turn lead to difficulties with learning to play with toys as the child can not turn his/her head to focus on the object (Cogher, Savage & Smith, 1992). Eating and drinking may also be impacted with poor ability to control food in the mouth or swallow the food safely (Cogher et al, 1992; Morris & Klein, 2000; Workinger, 2005) or hypersensitivity to food due to unpleasant feeding experiences (Winstock, 2005). These disabilities/impairments affect many aspects of development which include: physical development, such as walking; social development including limited or no eye contact due to limited attention, physical impairment or visual impairment; cognitive development which can include language and problem solving difficulties; sensory development which can be impacted upon by vision and hearing as well as aversions to taste and textures; ability to emotionally develop which may include strong reactions to things or being unaware of others around them and finally communication may be affected leading to poor language and speech, if able to verbally communicate (Cogher et al, 1992; Mednick, 2002; Orelove & Sobsey,

1996; Van Riper & Erickson, 1996). These issues can all have an impact on developing speech and language.

Children with multiple disabilities often have complex communication needs (CCN), therefore require specialist intervention from a variety of professionals including speech and language therapists, physiotherapists, occupational therapists, paediatricians and obviously the child's family and teachers (Crickmay 1966; Orelove & Sobsey, 1996; Van Riper & Erickson, 1996; Workinger 2005). These children often have difficulties with social communication and due to a limited access to the environment around them have limited opportunities for communication (Light, 1997). They may present with unintelligible speech or very limited or no speech (anarthria) at all. Even after having intensive therapy they still may not be able to develop spoken language (Sevick, Ronski & Adamson, 2004). This may be due to severe motor difficulties which are exemplified in some children with spastic cerebral palsy. These children may have severe difficulty coordinating articulation mechanisms such as breath, voice, tongue and lips at the same time to produce appropriate sounds (Cogher et al 1992).

Children with multiple disabilities who have limited speech are likely to use non-verbal modes of communication, where possible, such as pointing, eye gaze, and facial expressions (Mednick, 2002; Orelove & Sobsey, 1996; Stephenson & Dowrick, 2005). However, severe physical impairments may limit a child's use of conventional non-verbal communication strategies. To augment or supplement these children's communication skills some form of alternative and augmentative communication (AAC) may be provided (Beukleman & Mirenda, 2005; Downing, 1996; Orelove & Sobsey, 1996; Stephenson & Dowrick, 2005).

AAC is used for individuals with severe speech and language disorders who need another means to communicate and encourage participation in activities (American Speech-

Language-Hearing Association (ASHA), 2005). AAC facilitates an individual's ability to communicate, even if they continue to use other methods such as their voice, making them multimodal communicators (Allaire, Gressard, Blackman & Hostler, 1991). AAC can range from using signs, gestures and symbols including communication boards and eye gaze boards, to more high-tech voice output communication aids (VOCA's) such as the Vantage (Liberator, nd), Springboard (Liberator, nd) and Talara (Zygo Industries, nd). There are obvious benefits to using AAC in that individuals will be able to communicate some of their needs and wants. Parents have been found to be reluctant to use AAC due to the fear of their child's speech not being a priority for input (Beukleman & Mirenda, 2005; Schlosser, 2003). There is a need therefore to investigate conventional communication abilities with this population to discover if they can be effective multimodal communicators.

If a child with multiple disabilities does develop the ability to speak this is likely to be slower and atypical. This could be due to how they perceive the environment. For instance, if a child has a severe visual impairment, they may be unable to see objects, relying on others in their environment to provide labels and reducing opportunities for children to make spontaneous labelling attempts (Kekelis & Anderson, 1984). Children with a severe physical disability may not be able to manipulate objects or interact with people in a similar way to children experiencing typical development (Cogher et al, 1992; Pennington, 2008). Children who do have some speech may not use all phonemes therefore it may appear that they have a language delay/disorder (Pennington, 2008). All of these factors will have an obvious impact on the way that the child learns and develops language

Cerebral Palsy and the effects on communication

Cerebral palsy is a non-progressive motor disorder due to a defect or lesion in the immature brain which affects 1 – 2.5 percent per 1,000 live births in New Zealand and

western societies (Cerebral Palsy Society of New Zealand (CPSNZ), 2007; Cogher et al, 1992; Van Riper & Erickson, 1996). Cerebral Palsy affects an individual's ability to control muscular movements (CPSNZ, 2007; Cogher et al, 1992; Crickmay, 1966).

There are five subtypes of CP. These are spastic, dyskinetic, ataxic, hypotonic and mixed (Workinger, 2005). The children in this study have spastic CP (SCP) which is characterised by increased muscle tone and reduced motor control and range of motion (Crickmay, 1966; Van Riper & Erickson, 1996; Workinger, 2005). Children can range in their severity of CP and it can have varying impacts on communication (Crickmay, 1966; Van Riper & Erickson, 1996).

Of the children diagnosed with CP, 20 percent will present with a severe communication impairment and are non-verbal (Strand, 1995). The most common resulting speech disorder in CP is dysarthria which is caused by difficulties with oro-muscular control due to impairment of the motor processes which are involved in the delivery of speech (Darley, Aronson & Brown, 1975).

For children who have SCP the resulting dysarthric features can include low pitch, hypernasality, breathy voice, pitch breaks, excess and equal stress and problems with articulation (Kent, 2000; Pennington, Smallman & Farrier, 2006; Workinger & Kent, 1991). The child may also produce speech which "is explosive and punctuated by long pauses" (Crickmay, 1966, pg 10). Workinger (2005) goes further to state that children with CP have fine and gross motor difficulties and will therefore not have a significant memory of movement patterns when trying to produce speech.

Some children with CP may also have dyspraxic speech. This is where they appear to grope for the appropriate movements of the mouth. They are unable to achieve the target sound or oral motor movements and sequence them to make words (Cogher et al, 1992; Pennington, 2008; Van Riper & Erickson, 1996).

There has been some discussion regarding the ability for a child with CP and their ability to use the tongue tip. This would therefore impact on sounds such as [t] and [d]. Successful treatment provided has included teaching the child to raise the tongue to the upper-gum ridge to produce these sounds (Crickmay, 1966; Fogle, 2008; Van Riper & Erickson, 1996).

Cortical Dysplasia (CD) and Epilepsy and the effects on communication.

Cortical Dysplasia (CD) is described as malformations which can be focal or general in the cerebral cortex which can cause mental retardation and seizures in children (Cepeda et al, 2006; Medcyclopaedia, 2008; Rickert, 2006). There have been a number of reports of findings of up to 40 percent of cortical dysplasia when conducting surgery on individuals with epilepsy (Cepeda et al, 2006; Hilbig et al, 1999; Ricket, 2006; Vinters et al, 1999) therefore CD and epilepsy and the effects on communication will be discussed together in this section.

Epilepsy is described as a seizure disorder which is diagnosed after a person has two or more separate seizures that are 24 hours apart (Camfield, Camfield & Watson, 2002; Epilepsy, 2008). A seizure consists of an electrical burst by the cortical neurons which can be firing too many at once, abnormally and simultaneously (Driefuss, 1988; Epilepsy, 2008; Mednick, 2002). Seizures can impact on the brain and cause temporary changes and loss of consciousness (Dreifuss, 1988; Mednick, 2002; Orelove & Sobsey, 1996).

It has been estimated that between 30 percent – 51 percent of children with epilepsy also have additional disabilities such as cerebral palsy, learning disabilities and autism (Cogher et al, 1992; D'Amelio, Shinnar & Hauser, 2002; Selaisse, Viggedal, Olsson & Jennische, 2008). It has also been found that epilepsy and CD can have an impact on the development of language and cognitive processes (Klein, Levin, Duchowny and LLabre, 2000; Parkinson, 2002; Pennington, 2008; Selaisse et al , 2008; Tromp et al, 2003).

Intellectual Disability (ID)¹ and the effects on communication

Children who have an intellectual disability tend to have delayed development in some or all areas of development including intellect, language, motor skills, self-care and social skills (American Association of Intellectual and Developmental Disabilities (AAIDD), 2008; Shevell, Majnemer, Platt, Webster & Birnbaum, 2005; Van Riper & Erickson, 1996). Those with intellectual disability may also have additional disabilities including seizures, vision and hearing impairments and motor and communication disorders (Beukelman & Mirenda, 2005).

Intellectual disability is slightly different to developmental delay in that it focuses on the intellect of the individual where as developmental delay can include delay in intellect and/or delay in physical skills (AAIDD, 2008). Intellectual disability can be the result of limited social development in a young child. 40-50 percent of the cause of ID is unknown (AAIDD, 2008). It can also be an additional disability to a developmental disorder such as CP or Down's syndrome (AAIDD, 2008; Beukelman & Mirenda, 2005).

Toueg (2002) states that there is a 33 percent risk of a child with CP to be "educable to profoundly impaired" (p 116). Van Riper and Erickson (1996) go further to estimate that up to 50 percent of children with CP have an intellectual disability but also state that intelligence levels may be difficult to assess. Crickmay (1966) suggests that for a child with severe CP and low intelligence, speech may be unlikely but one who has higher intelligence may gain the use of speech.

A study by Schrieberg & Widder (1990) looked at the impact of intellectual disability on speech. They analysed the speech of 40, 20-50 year olds with intellectual disabilities, 12 percent of whom had Down's syndrome. No other data on the other 88 percent of participants was given. The level of disability ranged from mild to profound. The authors found that the subjects did tend to have specific areas of difficulty including deletion of "final consonants,

¹ Intellectual disability will be used to describe and include descriptions of global developmental delay, cognitive delay and mental retardation.

cluster reduction and syllable deletions” (p. 646) as well as token to token inconsistencies and vowel errors. They go further to state that the inconsistencies and reductions are consistent with the literature on people with intellectual disabilities, but there is suggestion that motor involvement in speech is not as significant as previously thought.

Language development can be delayed and the children will learn about the environment in which they live in different ways to normally developing children (Johansson, 1994). Three studies involved 41 individuals which focused on responses when presented with opportunities to intentionally communicate (Mclean & Snyder-Mclean, 1991). Examples of communication temptations included turning off favourite toys or forgetting to give the individual the key to a toy to encourage a response. The authors found that many of the participants were limited to proto-imperative (acts that request objects or actions or protests) forms but others did demonstrate communicative behaviours at the more advanced proto-declarative (directing another’s attention to something) stage. They also discussed that it is important for those around these individuals to be aware of their communicative interactions and to respond to these so that the individual will continue to use them and possibly develop more. Therefore analysing a child’s verbal and non-verbal language and how they use their communicative intent is important. This will aid in developing and providing opportunities for these children to communicate effectively using their own means.

Visual Impairment and the effects on communication

Visual impairment (VI) is common in individuals with multiple disabilities and can have a large impact on an individual’s functioning (Beukelman & Mirenda, 2005; van den Broek, Janssen, van Ramshorst and Deen, 2006). Sonsken et al (1991) (cited in Winstock, 2005) found that in addition to severe speech difficulties it has been estimated that up to 75 percent of children with CP have additional VI. According to Eltsner (1983) more than 40 percent of

children who are blind without additional disabilities have some difficulty with their speech. van der Broek et al (2006) found that of the 76 individuals with severe and profound intellectual and motor disabilities, including ID, CP and epilepsy, 92 percent had impaired visual acuity.

Visual acuity, visual field and the ability to see detail are all impacted upon when an individual is visually impaired (Beukelman and Mirenda, 2005; Sobsey & Wolf-Schein, 1996; van der Broek et al, 2006). Visual acuity is the ability to see and distinguish objects in detail (Beukelman & Mirenda, 2005; Sobsey & Wolf-Schein, 1996; van der Broek et al, 2006). Someone is deemed legally blind when their visual acuity is below 20/200 and is deemed partially sighted when their visual acuity is 20/70-200 (Beukelman & Mirenda, 2005; Sobsey & Wolf-Schein, 1996). Visual field is the area in which the individual can see (Beukelman & Mirenda, 2005).

It has been suggested that the inability to see how sounds are made could lead to articulation problems (Rowland & Schweiger, 1998), phonological disorders and delayed development (Dodd, 1983). Research by Mills (1983) found that one child who was blind did develop her phonetic repertoire in a normal, yet slightly different way to sighted children. The child had more difficulty saying the sounds that can be seen, such as [b], yet developed sounds produced that are not seen, such as [d], as a normally developing child would. A meta analysis of children with VI and their phonetic repertoires found inconclusive results on delays and development of speech sounds (Warren, 1994).

Language can also be affected, particularly with the language which is used with a child with VI. Parents may tend to name objects rather than describe them and talk to the child about their environment rather than the world around them, therefore reducing the language input that the child may receive (Kekelis & Andrew, 1984; Moore & McConachie, 1994). However it was also found that children with VI, without additional disabilities, can

develop language within the normal limits (Fraiberg, 1977). A further study found that children, in particular, those with Leber's Congenital Amaurosis, had a wide range of vocabulary but were unlikely to use it with intent (Fazzi, Signori, Scelsa, Bova & Lanzi, 2003). Another study which looks at intent found that with children who had multiple disabilities and visual impairment were more intentional in familiar routines (Iacono, Carter & Hook, 1998).

1.2 Alternative and Augmentative Communication (AAC)

Given the complex nature of their difficulties, it is likely that children with multiple disabilities and who have complex communication needs are provided with an augmentative and alternative way of communicating (Allaire et al, 1991; Beukelman & Mirenda, 2005; Clarke, McConachie, Price & Wood, 2001; Cogher et al, 1992; Marshall & Goldbart, 2008; Millar, Light and Schlosser, 2006; Pennington, 2008; Van Riper & Erickson, 1996).

There are a number of advantages of implementing AAC with children with multiple needs. For instance, even those individuals who have the most significant disabilities will be able to use AAC in one form or another such as using gestures (Beukelman and Mirenda, 2005). Blischack, Lombardino & Dyson, 2003 completed a meta analysis of AAC and described in a table (p 31) what the effects of speech generated devices were. These include; increasing turns in conversation and number of messages as well as the length of the message. Reducing demands on speech and physical movements. Providing immediate output and consistency and supporting the development for internal phonology.

In addition to improved communication, use of AAC has been linked to improved speech production. Millar et al, (2006) completed a meta analysis of studies on AAC and found that 82 percent of the participants showed an increase in speech production, 11 percent showed no change and seven percent decreased with their speech. The subjects were from the

ages of 2 to 60 years therefore these studies suggest that even once an individual has passed the critical stage for developing language there may still be a chance to develop language. They found that in studies where there was best evidence there was a mean increase of 13 words and six two-word phrases that were spoken.

Despite the advantages of AAC, there is some reluctance on the part of AAC users to utilise alternative systems. It has been found that the preferred mode of communication continues to be verbal output not only by the individual themselves (Marchant, McAuliffe and Huckabee, 2008) but also by caregivers (Allaire et al, 1991; Stephenson & Dowrick, 2005). One reason for reluctance is that parents fear that the child will not be given further opportunities to focus on their speech and that they understand what their child is saying (Allaire et al 1991; Beukelman & Mirenda, 2005; Schlosser, 2003; Stephenson & Dowrick, 2005). Parents have also been found to be more likely to reinforce verbal output if the child is showing some development of this (Allaire et al, 1991; Stephenson & Dowrick, 2005). It has also been highlighted that there is a need for more parental input in the selection of appropriate AAC aids and how to use them (Stephenson & Dowrick, 2005).

Beukelman & Mirenda (2005) suggest a multimodal approach to intervention and give examples of focusing on natural speech and motor skills 50 percent of the time and AAC 50 percent of the time or 10 percent of the time on natural speech and motor skills and 90 percent on AAC. This therefore does lend argument to the case, as with the above concerns regarding AAC, for focusing on developing speech with children with multiple disabilities.

1.3 Alternatives to AAC: Intervention aimed at improving speech and vocalisation in children with disabilities

Given the difficulties and reluctance some individuals have with the use of AAC, there have been investigations into the usefulness of intervention aimed at improving speech/vocalisation for communication.

Communication intervention and Cerebral Palsy

To date, there have been few intervention studies on speech and language therapy with children with CP. Pennington, Goldbart and Marshall (2005) completed a review of the literature available on speech and language therapy input with individuals with CP. They found that therapy which focused on expressive language and communication and involved operant and micro-teaching methods were effective, however, there was no evidence on specific areas of intervention including dysarthria therapy and articulation therapy.

Pennington et al (2006) completed a study on the effects of speech and language therapy on children with CP and moderate intellectual disabilities. The children in this study did speak in sentences. This therapy focused initially on breath control which is deemed necessary for the individual to be at their optimum position and ability to control their breath before attempting activities that focused on articulation, if any of the students were to get to this point of therapy. The research found that there was improvement of intelligibility after an intensive block of therapy, however all but one returned to their pre-therapy intelligibility after seven weeks. They discuss how the effects of a longer block of therapy may improve maintenance of intelligibility as well as presentation of stimuli.

Further studies on speech and language therapy with children with CP have focused on direct articulation therapy. Wu and Jeng (2004) completed a study with two children with CP who attended an elementary school and had moderate articulatory difficulties. One child had

therapy which focused on phonological therapy including minimal pair contrasts and speech bombardment. The other child received motor-based therapy which focused on phonetic placement (PPT), oral motor activities and speech modelling. Both therapy techniques did improve the specific phonemes that were targeted with the phonological approach appearing to help with maintenance. The phonetic based therapy appeared to improve the production more than phonological based therapy. However as the authors state the long term effects of this are unknown but the phonetic approach appears to be more beneficial when intervention takes place. There are some limitations to this study including having a limited number of children in the study and very little written about their disability and if they had additional disabilities. This study does focus on specific programmes on actual speech rather than focusing on breath control.

Another study focused on phonetic placement therapy (PPT) and biofeedback (Marchant et al, 2008). The participant was a teenager who had spastic CP, no additional disabilities, and was able to comprehend instructions associated with assessment and treatment. Her speech was her main way of communicating and she had a negative view on AAC. Therapy consisted of PPT with speech drills on five consonants and relaxation via sEMG biofeedback to *“inhibit muscle tension within the orofacial muscles using relaxation therapy”* (p 86). The results showed that phonetic placement did improve intelligibility at single word level. sEMG did encourage improved muscle control and maintenance of the improvements made from PPT. The use of one participant was an obvious limitation to this study. However drawing from this and the study by Wu and Jeng (2004) it does appear that articulation therapy has a positive impact on the phonetic repertoire of children with SCP. This is valuable research, however it would be interesting to see if it had the same effects with individuals not only with CP but also ID, as the literature on individuals with ID and articulation therapy appear to be inconclusive.

Communication intervention and intellectual disabilities

Sommers et al (1970) found that 353 children who were three years intellectually delayed and received group therapy four times a week significantly improved their articulation skills compared to a group who received group therapy once a week and a control group. Therapy focused first on improving sounds individually then increasing complexity by increasing number of syllables, words and spontaneous speech. The authors concluded that children with ID require ongoing therapy to improve speech as they did not appear to continue with improving their speech post therapy. There is no comparison of the benefits of individual therapy compared to group therapy and if this would increase or decrease the benefits of articulation therapy. They did however have a large sample size.

Wilson (1966) found that children, who had intellectual disability, who received two 30 minutes sessions per week, of the traditional articulation approach did not make any significant changes, however he did find that there were some positive effects of articulation therapy. This therefore raises the question of intensity of therapy as those children in the Sommers et al (1970) study did significantly improve their speech after intensive therapy. The above studies also show that articulation therapy can be of benefit to children with intellectual disabilities.

Communication intervention and visual impairment

Children with severe VI have a unique set of problems in that visual cues and prompts are unlikely to be useful. Suggestions regarding how best to work on speech with children with VI includes using touch. Eltsner (1983) suggests that speech therapy should be similar to that of a child who is sighted but with additional tactile stimulation. Therefore using auditory awareness as well as touch may be a useful way to aid the child who is blind in their speech development. Some children with multiple disabilities, including visual impairment,

can be tactile defensive around the mouth area, not only theirs but also other people's, due to difficulty in early feeding experiences which may have lead to hypersensitivity (Winstock, 2005).

Providing appropriate effective speech and language therapy for children with VI and multiple disabilities is a challenge for the clinician. A survey completed by House and Davidson (2000) found that research into providing therapy for children with visual impairment was absent and that 59 percent of the Speech and Language Pathologists/Therapists who responded did not feel knowledgeable about providing services to children with VI and 49 percent found that they did not feel proficient at assessing these children, however 53 percent had provided speech and language therapy with children with VI. The authors also discuss that if a child has other disabilities that this may become the focus of intervention which may lead to inappropriate therapy for the specific visual impairment.

1.4 Alternatives to AAC: Intervention aimed at improving speech and vocalisation in children who are normally developing.

As can be seen above traditional approaches to speech and language input with children with multiple disabilities have been used. Due to the lack of literature on the above populations, therapy provided for children with speech and language delays/disorders, with no additional disabilities with the exception of cleft palate, need to be evaluated. In this study two therapy approaches will be focused on; articulation therapy and core vocabulary therapy.

Articulation Therapy

The traditional articulation therapy approach was devised in 1939 by Van Riper after seeing therapy directed towards relaxation and sound production in words. The traditional

approach is still used widely today (Van Riper & Erickson, 1996). This approach follows a systematic way to develop speech sounds that are not produced. It focuses initially on listening to the target sound and distinguishing between that and another sound. The target sound is then produced in isolation, then the sound in syllables and non-words, then in words and finally in sentences. A full description of this approach is given in Van Riper & Erickson (1996).

Hesketh, Adams, Nightingale and Hall (2000) found that most clinicians tend to use an eclectic approach to speech sound production including articulation and phonological approaches. There were 61 children between the ages of 3;6 – 5;0 years with developmental phonological disorders, who had no other additional disabilities participated. These children were separated into two groups. One group received articulation therapy which followed the approach as described by Van Riper and Erickson (1996). The other group had metaphonological therapy which involved working on rhyming, syllable clapping, blending and phonological awareness. Both therapies improved metaphonological skills. There were no differences on the effect on speech, with the exception of articulation therapy actually improving on the probes. The authors did find that there was a reduction of improvement in percentage consonants correct when therapy was stopped for 3 months. This research does have implications for children with complex communication needs and multiple disabilities. It shows that both approaches appear to have a positive impact. However with children who have multiple disabilities, therapy may need to be longer. They may also need therapy to be continuous as the above research shows that children who are normally developing, with the exception of a phonological disorder, have difficulties maintaining what they have learnt in therapy.

Another study did look at the impact of articulation therapy and phonological therapy and the amount of time needed for improvements to be made (Pamplona, Ysunza & Epinosa,

1999). There were 29 children with cleft palate repair and compensatory articulation disorder who took part. The children were randomly placed into two groups. One group received traditional articulation therapy involving the steps as described by Van Riper and Erickson (1996). The second group received a phonologic approach which involved focusing on groups of sounds that were difficult rather than individual sounds. It was found that the children need less time in therapy when receiving phonologic therapy. This research does show that both sets of children did achieve success with their articulation. Once again, time is a factor for the differing intervention approaches. The implications for this with a child with complex communication needs and multiple disabilities is that if they were receiving regular therapy, would it be easier for them to practise the articulation approach as this focuses on one sound at a time, therefore potentially reducing the cognitive load. It will also allow the child to focus on how to produce that particular sound and achieve success as with the children with CP in Marchant et al (2008) and Wu and Jeng (2004).

Core Vocabulary Therapy (CVT)

Core vocabulary therapy focuses on a selection of target words and uses these repeatedly in clinical and natural settings (Holm, Crosbie & Dodd, 2005). This approach follows a structured programme involving teaching target words sound by sound, with additional visual prompts, and then syllable segmentation followed by whole word practice. These words are then practised in drills daily (Holm et al, 2005). This approach has been found to increase phonetic repertoire as well as expressive language. Studies on this approach with children with phonological disorders and cleft palate have found improvements in the development of vocabulary and generalisation into everyday environments. Children who were using this approach also developed a more consistent phonetic repertoire (Dodd &

Bradford, 2000; Dodd, Holm, Crosbie & McIntosh, 2006; Holm & Dodd, 1999; Scherer, 1999).

There has been no research found that focuses on the use of the core vocabulary approach and children with receptive language impairments and/or global developmental delay (Scherer, 1999) and those with articulation disorders (Dodd & Bradford, 2000). The authors of these studies suggest these children may produce different results to those achieved with children with cleft palate (Scherer, 1999) and phonological disorders (Dodd & Bradford, 2000).

The above studies have raised concerns about using this approach with different client groups. However, children with CP and/or ID are likely to have difficulties exploring their environment due to poor motor dysfunction. Therefore they have difficulty making mental representations and only when they have these representations can they express themselves linguistically (Falkman, Sandberg & Hjelmquist, 2002, Johansson, 1994). This statement would also be true of the child with additional disabilities, such as a visual impairment, as they are likely to explore their environment differently to a child who is sighted. They also may not be aware of common objects which could lead to the perception that the child has a lack of knowledge rather than a lack of experience (Lewis & Russo, 1998). Children with epilepsy could reduce their knowledge and experience of the environment around them if they have multiple seizures (Toueg, 2002).

Children with multiple disabilities need to have their communication potential maximised. Paul (2007) argues this point and states that using vocalisations even if they are not intelligible should be encouraged to gain another person's attention. Using core vocabulary with this population may help with these vocalisations. The students will be given target words to focus on for a period of time which will give the students specific functional words to use and therefore encourage vocalisations and formation of words. They will also

hear and attempt specific sounds relating to those words which may increase their phonetic repertoire.

1.5 Summary and Hypotheses

Research has shown that there have been some inconsistencies, in the findings, regarding the way children with disabilities learn speech and language. Motor and intellectual abilities as well as seizure activity and vision all play a part in the development of speech and language. Therefore if a child has difficulty in one or more than one area that child is likely to experience delays and/or disorders of speech and language.

There has been limited research regarding speech and language therapy for children with a single as well as multiple disabilities. The literature available shows that therapy appears to follow similar intervention patterns to that of children who have delays in their speech or language with no additional disabilities. There are additional techniques that are used, for instance; working on breath control of a child who has dysarthria secondary to CP, or using touch for a child with a visual impairment. It has been debated that the increased intensity and length of therapy does have a positive impact.

The above therapy techniques have been chosen as those deemed most suitable to work on with children with limited phonetic repertoires secondary to multiple disabilities. Traditional articulation therapy has been seen to be successful with children with CP and with some children with intellectual disabilities and focuses on one sound at a time and developing that into words and sentences. Core vocabulary therapy has been successful in building not only the phonetic repertoire but also the language of children who have delays in their speech or language but no additional disabilities. This study will enable comparisons to be made to the results of this approach with children with multiple disabilities.

The following hypotheses for this study are:

- 1) The phonetic repertoire of children with multiple disabilities will improve after traditional articulation therapy and core vocabulary therapy.

- 2) The communicative intent of children with multiple disabilities will improve after a combination of traditional articulation therapy and core vocabulary therapy.

Method

2.1 Research design

The research was conducted as three case-studies whereby treatment aimed at improving speech was implemented four times per week across six weeks for 20 – 30 minutes. Two treatment approaches were incorporated in the overall intervention programme. The treatment approaches were alternated to reduce multi-treatment interference effects (Maxwell & Satake, 2006) however the nature of the interventions and the time in which it was carried out, made it difficult to completely rule out carry-over between treatments. Speech and language measures were taken pre-intervention, between interventions, and post-intervention. Measures included baseline samples of phonetic repertoire and vocabulary. In addition, parent and teacher surveys collected post-intervention, provided information on communication intent and parent/teacher perception of intervention. A two-standard deviation band method was used to determine whether any significant change was noted mid-way and post-intervention.

2.2 Participants

The study involved three children who all attended the same school for children with very high needs and multiple disabilities in New Zealand. At the start of the study Jack² was 9;04 years old, Sam was 7;04 years old and Rachel was 6;08 years old.

The criterion for inclusion in this study was that all of the children had some verbal communication, although with a limited range of sounds, and they were diagnosed with multiple disabilities. All of the students used Alternative and Augmentative Communication

² * all of the children in this study have been given pseudonyms for confidentiality purposes.

(AAC) devices which were speech output devices. All of the communication devices are activated by pushing the keys and all of the children were able to do this independently.

The study took place within the school and as part of the child's weekly speech and language therapy programme. The children continued to receive group speech and language therapy sessions which involved using their communication aids to request items, deliver their home news, language based activities and feeding/cooking activities.

The children were assessed using a variety of assessments which focused on their receptive and expressive language, speech and communicative intent. Where needed the assessments were adapted for the child who was blind. Brief descriptions of the assessments are given below. The physiotherapy and occupational therapy teams at the school were consulted to ensure best positioning for each child. Further in-depth case histories are provided in the results. This includes descriptions of individual disabilities and any differences which occurred during the interventions.

2.3 Procedure

This study had four phases; an assessment phase, a target selection/baseline phase, an intervention phase and a post-intervention phase. A detailed description of each follows as described in table 2.1. Each phase was videotaped for later analysis using a Sony handycam, model number DSRHC96E. The study lasted for 21 weeks including pre and post intervention phases. All assessments and intervention procedures were carried out at school.

Table 2.1 Pre and post intervention phases.

| Phase | Activities |
|---------------------------------------|---|
| Assessment phase | <ul style="list-style-type: none"> ▪ A range of assessments completed to gain full understanding of child's communication ability prior to intervention beginning and only completed before the first block of intervention. ▪ Articulation assessment using Nuffield Dyspraxia Assessment completed to assess phonetic repertoire. ▪ Macarthur-Bates Communicative Development Inventories given to parents to discover their understanding of their child's speech and language abilities, prior to start of first block of intervention only. ▪ Communicative intent and phonetic repertoire in everyday situations assessed. |
| Target selection/baseline phase | <ul style="list-style-type: none"> ▪ Three baselines were taken over a week to check if words/sounds were correctly selected. |
| Intervention phase – Articulation/CVT | <ul style="list-style-type: none"> ▪ Four intervention sessions per week for a total of six weeks focusing on one intervention approach, depending on which was randomly assigned first. |
| Post – intervention phase | <ul style="list-style-type: none"> ▪ Final baseline taken four weeks post intervention. ▪ Reassessed articulation using Nuffield Dyspraxia assessment four weeks post intervention. ▪ Communicative intent and phonetic repertoire in everyday situations assessed four weeks post intervention. ▪ Survey given to parents and teacher four weeks post intervention to assess if changes had been noticed at home and at school. ▪ Parents given Macarthur-Bates Communicative Development Inventories to complete four weeks after the second intervention was completed. This was to see if there were any changes that could be related to intervention, however this was not evaluated in the results as this assessment proved to be very subjective. |

Assessment Phase

The following assessments were carried out prior to intervention;

The Preverbal Communication Schedule (PVCS) (Kiernan & Reid, 1987) assesses pre-communicative, informal and formal communication skills of a child with severe learning disability. The visual activities were not suited to the child with visual impairment (Hendrick and Mclinden, 1996) therefore this was made note of when analysing the results.

The Preschool Language Scale (PLS 4) (Zimmerman, Violette, Steiner & Evatt Pond, 2002) is designed for children from birth to six years of age and includes norms of 1,500 children with disabilities. The assessment focuses on the child's ability to communicate functionally and their level of understanding.

Communicative intent was evaluated using a Communication Intention worksheet (Paul, 2007). The worksheet examined children's use of different communication functions including request action, request object, protest, comments, request for information, answers and acknowledgements. The worksheet also evaluated children's mode of response; gesture versus vocalisation versus words.

Speech – Speech production was assessed using the Nuffield Dyspraxia Assessment (Connery, 1992). Each child listened to a sound and were asked to repeat without the assistance of visual cues. The Nuffield Dyspraxia Assessment (2008) is used for children with any speech difficulties and can be used as an assessment and as a therapy tool. It is designed for children between the ages of 3 and 7 years, but adaptations can be made for those who are younger or older.

Oro-motor assessment – An informal oro-motor assessment was carried out to determine the levels of motoric function that each child had and the potential impact that could have on particular speech sounds.

Macarthur-Bates Communicative Development Inventories (CDI) (Fenson, Marchman, Thal, Philip, Dale, Reznick & Bates, 2007) – is an assessment for children aged between 8-37 months. It can also be used with children who have developmental delays. The assessment has two forms: words and gestures and words and sentences. The assessment is filled out by the parents. The assessment covers a wide range of words and phrases and actions. It also looks at semantic and syntactical structures.

Target Selection and Baseline Probes

Sounds were chosen based on ease of production. The decision to target 'easier' sounds was determined on the severe motoric and cognitive difficulties of the children in the

study. Target sounds did not necessarily follow the developmental norms as sounds such as [d] were more difficult to produce than [f] due to motor function.

Objects beginning with the target sound were presented to the child and a request was made for the child to name the object. If there was no response, semantic clues were provided. If there was no response then elicited imitation was used. If a sound was produced more than 40 percent of the time during the baseline stage then it was excluded.

In addition, to phoneme targets, 20 target vocabulary items were selected based on parent and teacher consultation, as with previous studies focusing on core vocabulary therapy (Dodd & Bradford, 2000; Holm & Dodd, 1999; Scherer, 1999). These were then made into Boardmaker (Mayer-Johnson, 2007) symbols and placed on a card with Velcro. These symbols were supported by objects cues where possible. If a child had visual impairment, additional semantic cues were given to aid in describing the symbol. If there was no response to extra semantic cues then the word was elicited via imitation or a no response was recorded. If a word was produced more than 40 percent of the time during the baseline stage then it was excluded. The first five responses, including no response, were analysed.

Intervention phase

Intervention was clinician-directed and used a drill-play format (Holm et al, 2005; Paul, 2007). Drill play was chosen as it is motivating to the child while eliciting a large number of productions of the target words and sounds. The therapy activities used objects and colourful pictures to maintain the interest of the children, and in particular toys which were noisy to encourage interest of the child with visual impairment. Families and teachers were also given the list of target words or sound and were asked to model the word at least 10 times per day. Intervention involved two types of approaches: an articulation therapy

approach and a core vocabulary approach. Although the sessions were similar there were some key components of each type of therapy. They are described in the following section:

Articulation Therapy

The articulation therapy approach involved focusing on one phoneme at a time and progressed from listening to production in isolation to using the phoneme in everyday speech (Van Riper & Erickson, 1996). This was deemed the most appropriate form of therapy as the children have very limited phonetic repertoires which do not appear to follow the developmental norms as cited in Van Riper and Erickson (1996). The key steps in the articulation therapy were as follows:

Auditory discrimination

The child was introduced to the target sound to be worked on such as [f] by giving them the object cue (a toy fish) and then being told what the sound was. They were then introduced to another object (ball) which represented a contrasting sound such as [b]. Children were instructed to listen for the target sound and identify the object that represented the sound. Feedback was given and the child was directed to the correct object.

Production of the sound in isolation.

Phonetic placement therapy (PPT) and cued articulation were used to encourage the child to produce the target sound in isolation. PPT consists of teaching where the lips, teeth and tongue should be positioned when making a sound (Bleile, 1995). Bleile describes that the researcher can modify the techniques by using items such as food to encourage correct positioning. An example of phonetic placement with [f] is:

“Instruct the client to touch his or her lower lip with the bottom of the upper front teeth and then to blow, which often results in [f]. In more severe cases, move the client’s lip to the correct positions using a finger or tongue depressor. Alternatively, instruct the client to “bite” the lower lip with the upper teeth and then to blow.” (Bleile, 1995, pg 324)

Cued articulation (Passy, 1990) was designed to facilitate production of sounds by using simple hand cues. An example of a cued articulation of [f] is used with photos of the index finger of the right hand between the lips and the chin. It is described as:

“As the /f/ is articulated the shape of the hand remains the same but is moved downwards and forwards for approx. four inches (10cm). Then movement of the hand shows the air is continuing out of the mouth to produce this sound.” (Passy, 1990, pg 18).

The target sound was described using phonetic placement and then the hand cue for the target sound was shown. The child was encouraged to do this with hand over hand assistance to begin with. Cued articulation was used to give the child an indication of what sound was being made, however if they were aversive to this due to oral defensiveness this was reduced and auditory cues were relied upon.

Once the child had been introduced to the target sound they were encouraged to imitate the sound up to 10 times and games were played to increase the number of times the sound was spoken. If the child found it difficult to produce the sound they were given encouragement to try it again; such as “that was a good try, now try and put your top teeth on your bottom lip to hide it and then blow”.

Production of sound in consonant vowel (cv) and cvcv sequences

When the child was able to produce the sound in isolation they were encouraged to produce it in a cv sequence, such as [fa], [fi]. At first the two sounds were separated to ensure that the child could make these sounds. The child was then encouraged to put the sounds together. The activities that were used for the sound in isolation were used for the sound in a cv combination. If the child was then able to become consistent with cv combination, vc such

as [if] [ɔf], and cvcv, such as [famə], were attempted. If the child was able to say a word she or he was encouraged to fill in the space in songs using the cv or vc or cvcv word. None of the children were able to move on from this stage during intervention.

Core Vocabulary Therapy

The core vocabulary therapy approach focused on 10 target words. These were introduced randomly and two new words per week were presented, whilst the previous words continued to be focused on to encourage maintenance. This therapy was based on the research of Holm et al (2005). Only 10 words were used to ensure that the children were not cognitively overloaded. The words chosen for each child was similar to those suggested by Holm et al (2005) and included the subject areas of

familiar people: mum, dad, names of siblings

function words: toilet, help, finish, name of AAC device

food: food, drink

places: home, school, park

favourite things: drum, guitar, puzzle

Holm et al (2005) also recommended that only two sessions per week for six/eight weeks. In this study there were four sessions per week for six weeks this was so the child received intensive treatment, as this has been seen as effective for children with multiple disabilities (Sommers et al 1970).

The first session of each week focused on the two new target words. The two new target words were introduced as suggested by Holm et al (2005). The words were broken down into individual sounds and spoken with extra prompting by using cued articulation, for example:

finish was produced as “f” “i” “n” “i” “ʃ”

then “fi” “ni” “ʃ”

then “fi” “niʃ”

then “finiʃ”

The child was encouraged to repeat each sound, then syllable and finally whole word. Phonetic placement and cued articulation were used as prompts and where possible and appropriate the word was signed using Makaton (1998). Semantic cues or imitation was used if the child did not label the object or symbol to encourage elicitation. Some of the words were less motivating than others such as “toilet” compared to “guitar”.

Post-intervention phase

A post baseline was carried out four weeks after therapy which was the same as the pre-intervention baseline. Four weeks after each block of intervention the articulation assessment and class video was carried out to assess whether the child had made any improvements. A survey was also completed by the parents and teacher to evaluate their opinions on the child’s progress during therapy. After the second block of therapy additional assessments took place: CDI and a home video assessment. This was to evaluate any changes that had been made in the child’s communication.

2.4 Reliability

To evaluate the reliability of the children’s phonetic productions during sessions including; assessments of phonetic repertoire, baselines of articulation therapy and core vocabulary, language sample from class video and intervention sessions was carried out. Inter-rater reliability was carried out on 10% of the sessions by a qualified Speech and

Language Therapist (SLT) who was familiar with the client group but had not worked with any of the children in this study. The SLT was given instructions to transcribe the videos, and write down each utterance the child made when prompted to say the word/sound or when they were spontaneously using it with intent. These were compared to the researcher's results and a mean percentage was taken. The results showed that there was 57% agreement on all of the spoken phonemes, including both consonants and vowels. However when analysing only the target sounds there was 71% reliability and when analysing the accepted form of the target word, including for Sam the accepted number of syllables, there was 70% reliability.

Results

The aim of the study was to determine the effect of a combined intervention approach on speech and language of children with multiple disabilities. The results of the three case studies are presented below. Although primarily descriptive, the significance of the changes was inferred by implementing a two standard-deviation method by which changes that were greater than two standard deviations above the baseline mean were considered significant.

3.1 Jack

Background Information

Jack was diagnosed with Leber's congenital amaurosis leading to total blindness and cerebral palsy. In addition to this he had epilepsy and global developmental delay. Jack was non-ambulatory except for when using his walker or has adult assistance. He has shown tactile defensiveness around his mouth which could have been due to poor feeding experiences early on in life and restrictions on the texture of his diet. Cues were given to encourage him to eat for instance using counting to let him know how much he had left to reduce his aversion to eating.

He has attended the school since he was five years old and received regular speech and language therapy, physiotherapy and occupational therapy alongside his educational programme, during school time. He has also attended a specialist unit two afternoons a week and has regular contact with a visual resource teacher in addition to being at the school. Previous speech and language therapy had focused on developing his phonetic repertoire, increasing receptive and expressive language and improving his ability to use his AAC device.

Pre-intervention Assessment

Jack was assessed for all areas of communication. A table to summarise the results is below. Some assessments were difficult to complete due to Jack's vision and his resistance to particular tasks, particularly the oro-motor assessment.

Table 3.1 Pre-assessment results for Jack.

| Assessment | Outcome |
|--|--|
| Informal Oro-Motor | <ul style="list-style-type: none"> ▪ Refusal for some activities. ▪ Full range of tongue tip movement when out of mouth – limited movement in the mouth. |
| Speech | <ul style="list-style-type: none"> ▪ Produced – [m, b, p, j, h] consistently. [r] was developing and he produced [g] once and has attempted [k] but found this difficult. ▪ Produced - ə, ʌ, i, a ▪ Produced consonants in all word positions with some verbal prompting needed at times. ▪ He used mainly vv, vvv and at times cv sequences. |
| Pre-verbal skills | <ul style="list-style-type: none"> ▪ Some parts of this assessment needed visual interpretation therefore were disregarded for Jack. This does still show up areas that Jack is therefore delayed in due to his vision. ▪ Jack was functioning at a formal communication skills level and was able to use communication through speech. ▪ He was able to imitate sounds and imitate some motor functions such as; smacking table with hand or tapping a pencil on a table. |
| McArthur Bates Communicative Development Inventories | <ul style="list-style-type: none"> ▪ Understood 267 words/short phrases. ▪ The subject areas understood included animals, household objects, food, drink, descriptive and action words e.g. carrots, kick, do you want more. ▪ Said 49 words. ▪ Words spoken included – animals, body parts, people and games/routines e.g. bee, apple, ear. |
| Receptive and Expressive Language | <ul style="list-style-type: none"> ▪ Missed some parts due to lack of vision. ▪ Jack was on the 1st percentile for both receptive and expressive language sections of PLS-4. ▪ Has been observed informally and found to use three - four key word commands on concepts he knew; such as body parts. ▪ He was using up to four words in a sentence [ə ə əə pi] “I want Talara please”. |
| Observations/communicative intent | <ul style="list-style-type: none"> ▪ When he was on his own he amused himself with toys and “singing” to himself, using the [ə] sound, with appropriate intonation. Does not tend to initiate any interaction when playing by himself. ▪ In structured session – circle time- Jack was more interactive. ▪ He requested for his turn, occasionally needing prompting. ▪ He sang parts of familiar songs. ▪ He asked for his AAC device and gave his news. ▪ Was aware of what was happening next due to structured routines. |

Intervention

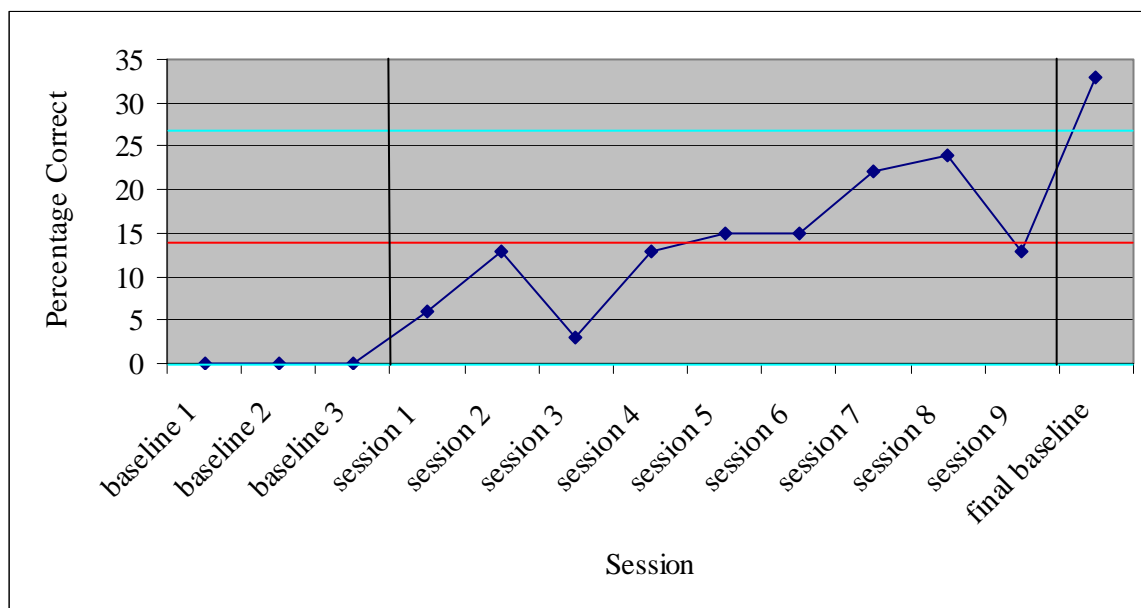
Jack was randomly chosen to receive articulation therapy first followed by core vocabulary therapy. Jack attended both sets of baselines pre and post-intervention at school and was videoed in his class pre and post intervention. He had a seizure during the third week of both blocks of intervention and was hospitalised on both occasions. He was able to continue with some sessions in the second block of intervention, two of which were conducted at home, as he was not at school.

Articulation Therapy

Articulation therapy focused on the production of [f]. The accepted production of [f] was one full exhalation; however this was without correctly approximated teeth and lip placement. Jack was often prompted to produce [f] and given instructions on how to make the sound.

Jack was unable to produce [f] during the initial baselines. Jack improved his production of [f] in isolation by 14 percent during therapy. He was able to achieve above 20 percent in sessions seven and eight which is likely to be due to familiarity and practise of the sound. He was able to produce [f] with one breath by 33 percent. Production of [f] in the post-intervention baseline was greater than two standard deviations above the intervention mean, although significance is only inferred as there was only one post-intervention baseline measure.

Figure 3.1 Percentage of [f], with one full exhalation, produced in isolation, per session.



Jack was beginning to develop his use of [f] in cv and cvcv sequences two sessions prior to his seizure. He was able to produce the cv structures by 25 percent and 51 percent and in the final baseline 22 percent. The cvcv structure was not produced in session eight and then 25 percent in session nine; this was not assessed in the final baseline.

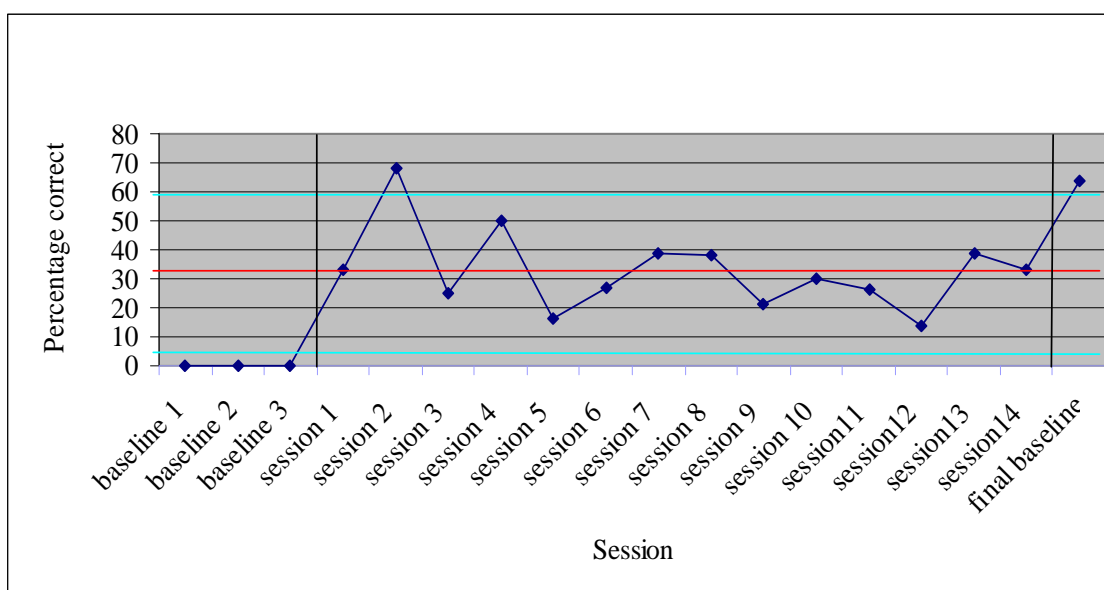
Core Vocabulary Therapy

The core vocabulary therapy focused on 10 target words chosen from a selection of 20. Two new words were introduced each week and the previous target words were also included in the concurrent sessions, as the results below show. The words were prompted the majority of the time, with each word being broken down into individual sounds, syllables and then the whole word.

At baseline, Jack was unable to produce any of the target words. Throughout intervention, he produced approximately 32 percent of the words in an accepted form (see Appendix D for accepted forms). An exception was in session two where he produced 70 percent of the accepted form of the words. This may have been because there were only two

target words to focus on and his interest in this activity was high. At the final baseline, Jack was able to produce 64 percent of the accepted form of the ten target words. As there is only one final baseline point, it is difficult to say whether the change would be sustained and significant, however it is greater than two standard deviations above the intervention mean. Figure 3.2 shows these results.

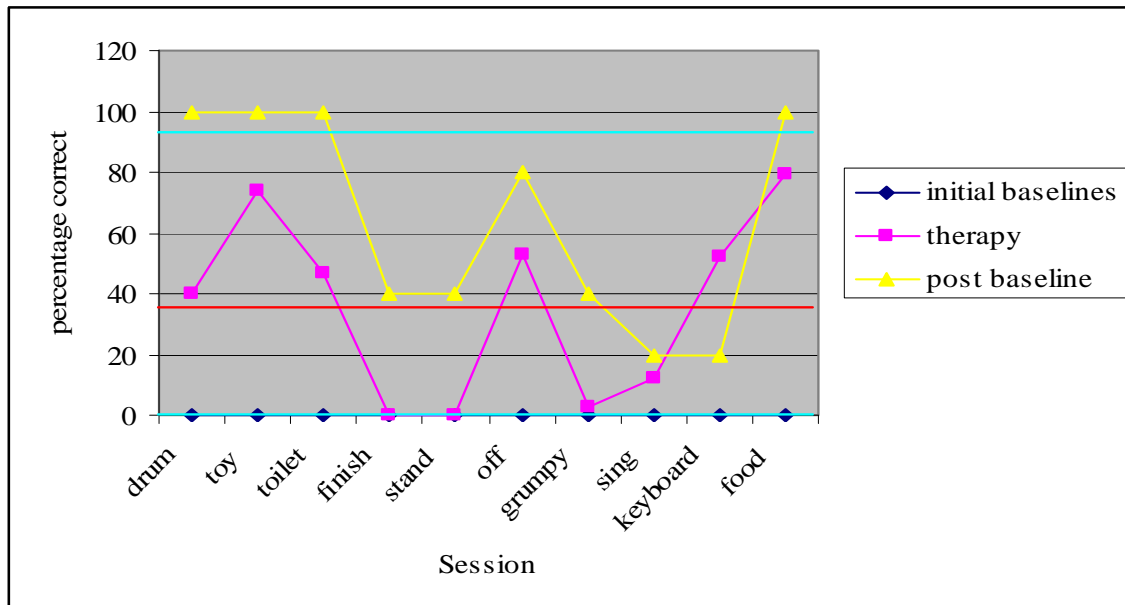
Figure 3.2 Total percentage of words spoken in their acceptable form per session.



In order to further understand the changes that occurred in word production, a word by word analysis was conducted. Figure 3.3 shows the target words drum [rʌm], toy [ɔɪ], toilet [ɔɪə] and food [fʊ/fʊə] showed significant improvement in the final baseline, with percent correct being greater than two standard deviations above the mean. During the intervention Jack achieved 36 percent of the target words in their accepted form. Food [fʊ/fʊə] and keyboard [ɪbəə] were accepted with the extra vowel on the end as Jack used [ə] in replacement of [d]. He also used [ə] as a replacement to other sounds that he cannot produce.

Figure 3.3 also shows that there were positive changes in the words; ‘off’, ‘grumpy’ and ‘keyboard’ during and post intervention. All of the words showed some improvement post intervention with all of them being produced in an accepted form at least once.

Figure 3.3 Total percent of syllables spoken correctly per session.



The non-target words showed some change. Six out of 10 words changed to be of a recognisable, but not phonetically correct, form. Therefore it appears that there has been some generalisation from the intervention.

Phonetic Repertoire

Articulation therapy appeared to have the biggest impact on Jack’s phonetic repertoire with the increased production of [f]. It also appears that [s], which was produced in a similar way to [f], became more consistent. Core vocabulary therapy did not appear to have lasting effects on Jack’s phonetic repertoire, as can be seen in table 3.2, however production of [ʃ] was noted twice during therapy.

Table 3.2 Changes in phonetic repertoire for Jack.

| Articulation therapy | | | |
|-------------------------|---------------|--------------------------------|----------------------|
| | Pre-treatment | during treatment | post treatment |
| Nasals | m | m | m |
| Stops | p, b | p, b | p, b |
| Fricatives | h | f | f, s (ingressive), h |
| Approximants | j, ɹ | ɹ | ɹ, j |
| Glide/Liquid | | | |
| core vocabulary therapy | | | |
| | pre-treatment | during treatment | post treatment |
| Nasals | m | m | m |
| Stops | p, b | p, b | p, b |
| Fricatives | f, s(ing), h | f, s (ingressive), ʃ (2), h | f, s (ingressive), h |
| Approximants | ɹ, j | ɹ | ɹ, j |
| Glide/Liquid | | | |

Parent/Teacher Survey

Articulation therapy

Jack's mother reported that he had improved his speech sounds and was more talkative. His class teacher stated that "he tries more sounds, even ones he is unfamiliar with." His mother went further to comment that she was well informed on the approach and was trying to work closely to ensure that the "learning is consistent both in school and at home."

Core Vocabulary Therapy

Jack's mother stated that he was trying hard to make the sounds and "is using them more when familiar songs or rhymes are played." She also reports that he is now clear with [d], [f] and [s]. His teacher states that he is beginning to use syllables to allow himself to be understood more clearly.

Jack's mother said that he tends to only initiate for food or toys but has more of an understanding of "choices of things that he's asking for." Jack's class teacher also reported

that when Jack waited for morning tea he would request toys or songs if he heard a person's voice and his confidence had increased

Jack's mother stated that he is "usually not keen to work or respond to this therapy at home" but that this therapy "helped him to imitate much more clearly what he's heard repeated to him especially it being a long sentence."

Communicative Intent

As commented above the families and teacher report that Jack's communicative intent did in fact improve after therapy in that he had begun to initiate more. The data from the classroom/home sessions were observed and the communicative intent form (Paul, 2007) was completed (see Appendix E). There was limited change with Jack's communicative intent. The biggest change was after core vocabulary therapy and his ability to request objects. He was more spontaneous with his requests and used consonants consistently in specific words, especially in the 10 target words used in therapy e.g. drum [rʌm].

3.2 Sam

Background Information

Sam was diagnosed with spastic quadriplegia after a pre-term delivery as one of triplets, at 27 weeks. He was non-ambulatory, however was walking with the aid of equipment such as a Rifton (nd) pacer. He had a nasogastric tube in the second year of his life and has had reflux. Sam had behavioural feeding difficulties and had an aversion to soft textures and preferred to eat hard textures such as crackers. At the time of the start of the study he had begun to eat softer foods such as sandwiches before his crackers. He chewed

food well and does not have any struggling behaviours when eating or drinking. He has vomited in situations that were unfamiliar or that he disliked.

Sam attended the special needs school three days a week and attended a mainstream school two days a week. He started at the school the previous year. Sam received regular speech and language therapy, physiotherapy and occupational therapy alongside his regular educational programme at the special needs school prior to and during the intervention. Since starting school he has received therapy at least twice a week on an individual and group basis which has focused on developing his speech sounds in particular [m], choice making, receptive language skills, and his ability to use alternative and augmentative communication.

Pre- Intervention Assessment

Sam was assessed for all areas of communication. Table 3.3 summarises the results. Some assessments were difficult to complete due to Sam's attention and motor function secondary to his CP.

Intervention

Sam was randomly chosen to complete a block of core vocabulary therapy followed by articulation therapy.

Core Vocabulary therapy

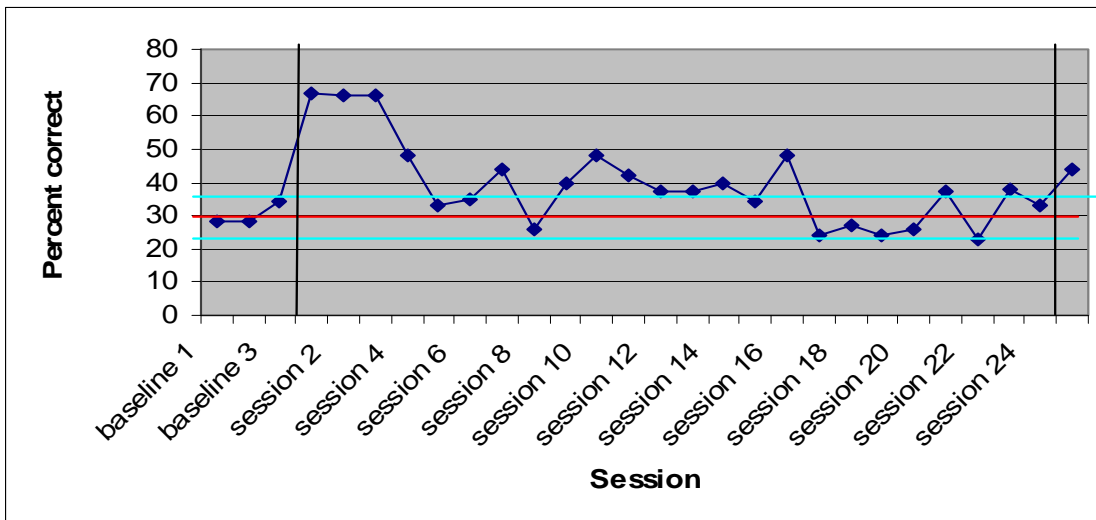
Sam's first block of therapy was core vocabulary therapy which focused on 10 target words. This started with two words initially and an extra two words were added per week, with the previous words still being targeted. Sam was often prompted to say the words, which were broken down into isolation, syllables and then the whole word. In the final week of therapy Sam was encouraged to be more spontaneous and there was limited prompting.

Table 3.3 Pre-assessment results for Sam.

| Assessment | Outcome |
|--|--|
| Informal Oro-Motor | <ul style="list-style-type: none"> ▪ Sam was distracted throughout assessment. ▪ He was able to bite down on wooden spatula. ▪ He was also able to put his lips together to make [m], however his jaw and body were tense when doing this. ▪ He had difficulty following instructions for movements e.g. when requested to stick out his tongue he produced [m] instead. |
| Speech | <ul style="list-style-type: none"> ▪ Sam produced [g] with limited effort. This is the main consonant that he used. ▪ [m] was developing, however he did exhibit some struggling behaviours and tension in the face and body. ▪ He used the following vowel sounds - [ʌ, i, ə, ɔi]. ▪ He used cv,cvcv, cvcvcv sequences mainly with [gə]. |
| Pre-verbal skills | <ul style="list-style-type: none"> ▪ Sam was developing with all of the pre-communicative behaviours with the exception of music and singing. ▪ He was beginning to develop his motor and vocal imitation skills. ▪ Sam was developing most areas of informal communicative behaviours but was yet to develop his formal communication skills. ▪ Sam has developed his attention seeking skills and his understanding of speech and vocalisations. ▪ He was also developing his motor and vocal imitation skills but did not use shared attention for example; trying to gain someone's attention to an object. |
| McArthur Bates Communicative Development Inventories | <ul style="list-style-type: none"> ▪ Sam understood 251 words on subjects such as; animals, vehicles, food, drink, people and action words such as car, mum, open. ▪ He said 27 words which included the above subject areas. The sounds he used to make these words are limited. |
| Receptive and Expressive Language | <ul style="list-style-type: none"> ▪ Sam was on the 1st percentile of the PLS-4. ▪ His expressive communication was severely limited due to his very limited phonetic repertoire. ▪ He understood actions and body parts, however some parts of the assessment proved difficult due to his motor function such as taking a block out of a box. |
| Observations | <ul style="list-style-type: none"> ▪ Sam liked to play on the floor with noisy toys around him. He interacted if someone was working with him. He vocalised to gain attention. ▪ During circle time he often interrupted others by vocalising. ▪ He vocalised to request a turn and was learning to wait to give his news. ▪ He was developing his skills at using his AAC device functionally. |

Sam was unsuccessful at producing any words that were recognisable as he had a very limited phonetic repertoire of [mə] and [gə] and some vowels (see Appendix D for accepted form). However, he did attempt to produce words with the correct syllabic structure therefore this was the focus of the results. Therefore the baselines were still accepted, even though he did manage to produce some words with the correct syllable structure more than 40 percent of the time. This is because changing how to analyse the results was decided post-intervention.

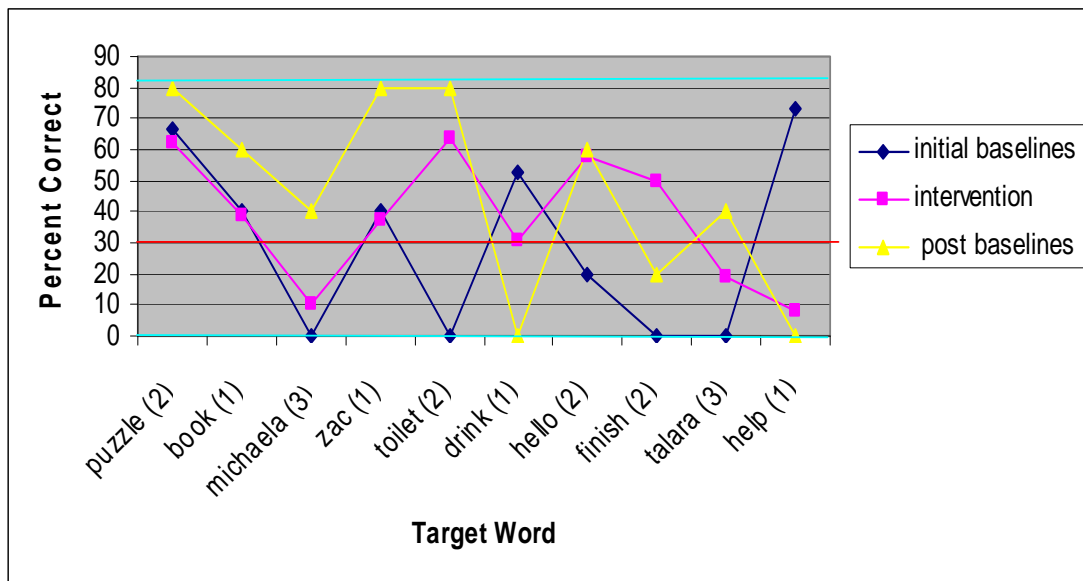
Figure 3.4 Total percent of syllables spoken correctly per session.



At baseline Sam produced approximately 30 percent of the target words. This increased significantly in the early sessions but his performance returned to baseline level in the final two weeks of intervention. It is possible that the words selected for Sam in the early sessions were somewhat easier for him to produce or that there was a reduced cognitive load. Figure 3.4 does show that when the standard deviation is taken from the baseline Sam has made significant changes in the production of correct syllabic structure.

A word by word analysis shows that Sam was able to produce 30 percent of the words with the correct syllable structure at baseline, 37 percent during intervention and 46 percent in the final baseline. The words containing two syllables were all produced above the mean and in particular puzzle and toilet achieved over 60 percent success during intervention and 80 percent success in the final baseline. Sam did find words with three syllables the most difficult to produce. However, he did show some improvements in producing Michaela [mægəgə] during intervention. Figure 3.5 depicts these results and shows that none were produced significantly.

Figure 3.5 Total percent correct of all sessions per target word.

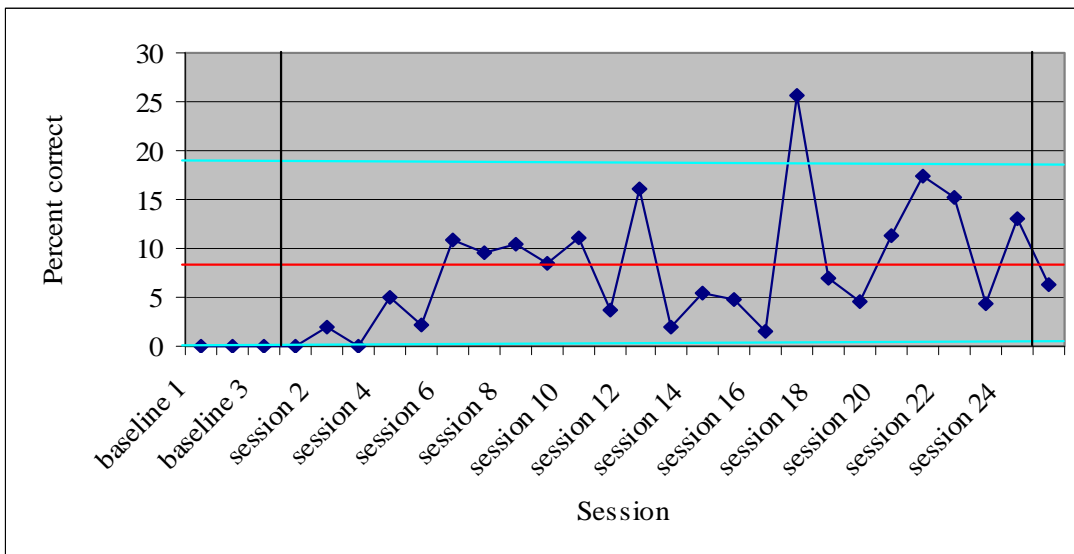


The non-target words showed inconsistent results as some words were produced with the correct number of syllables at the initial baselines and not at the final baseline. Some were produced erratically with the correct number of syllables at some of the initial baselines and final baseline. Computer was the only consistent word which was not produced with the correct number of syllables once, however this is highly motivating for Sam and therefore this may have been due to excitement.

Articulation Therapy

Sam focused on the sound [b] in this block of therapy. This was because he can produce [m], also because it is a sound that is produced early on developmentally and can be seen clearly. Sam produced [b] in isolation but would often produce it with another consonant such as [mb] or [gb] or [bg]. Therefore this has still been recorded in the results as it shows he is using his own method of producing the sound which was effective for him.

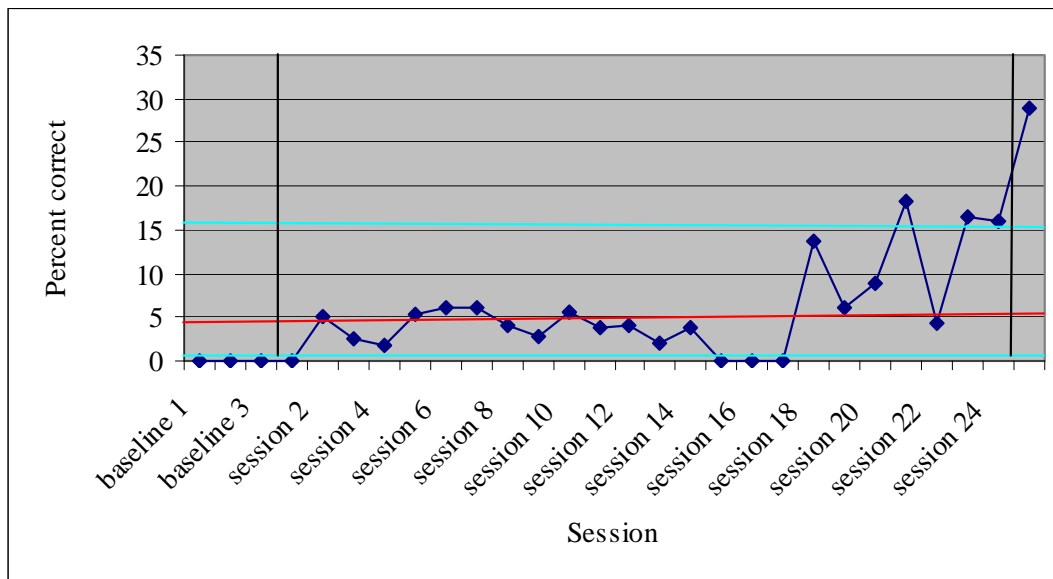
Figure 3.6 Percent of [b] spoken correctly in isolation per session.



At baseline, Sam was unable to produce [b]. During intervention he was able to produce it on average seven percent of the time. Session 17 shows an increase of this to 25 percent and is above the two standard deviations. Prior to this session, Sam's ability had shown a marked decrease, after session 12, which could have been due to the researcher being away for two weeks. In addition to this Sam was aware that he was moving to another part of the country which did upset him therefore making it difficult for him to attend to task. These results can be seen in figure 3.6.

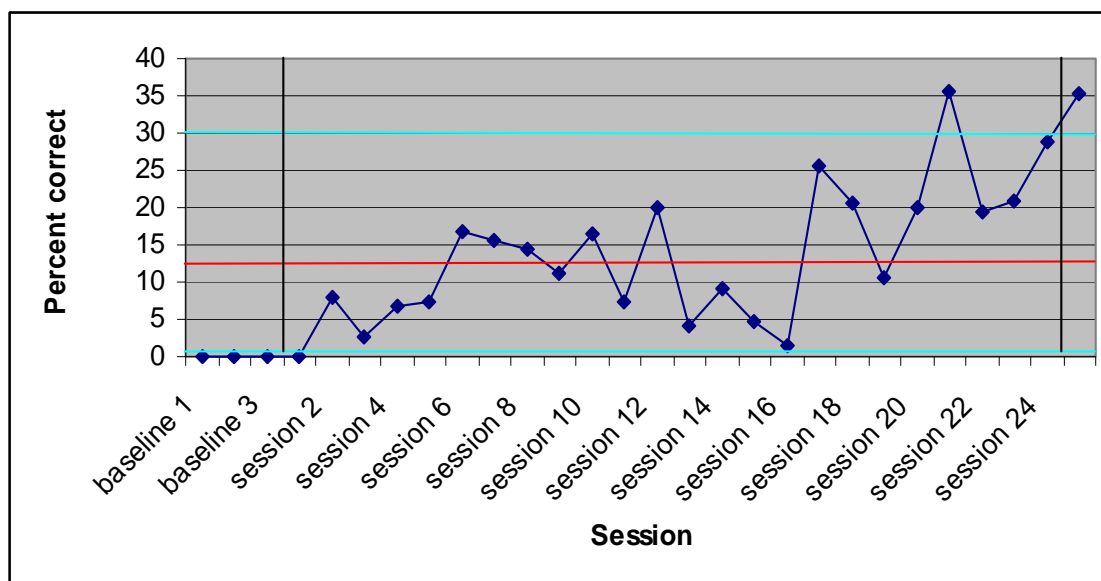
Analysis of [b] produced with an additional consonant shows that he was able to produce this five percent of the time during intervention. However from session 19, there is a marked increase in this production, which is significant. The final baseline shows an increase of production to 29 percent.

Figure 3.7 Percent of [b] spoken with another consonant, per session.



The total percentage of [b] that Sam produced during intervention was 13 percent. This is shown in figure 3.8. He was able to achieve production over the two standard deviations in session 21 and the final baseline. Once again there is a decrease after session 12. Figure 3.8 shows that after session 16 there is a gradual increase in production which could indicate that Sam was becoming more familiar with production of the sound and how to make the sound with his mouth rather than producing [g] when asked to say a consonant sound.

Sam was prompted to produce [b] throughout therapy and in the final baseline. He would often exhibit struggling behaviours and show tension in his face and body. He was developing his production of book [bæg] which those around him were able to understand, although this was only heard on a few occasions.

Figure 3.8 Total percent of [b] spoken in isolation and with a consonant, per session.

Phonetic Repertoire

Table 3.4 shows that Sam's phonetic repertoire has increased. Sam did produce [d] and [k] on a few occasions during core vocabulary therapy which suggests that he would be able to make these sounds in the future, however core vocabulary therapy had no apparent effects of maintaining new sounds in Sam's phonetic repertoire.

Table 3.4 Changes in phonetic repertoire for Sam.

| | core vocabulary therapy | | |
|--------------|-------------------------|------------------|----------------|
| | Pre-treatment | during treatment | Post treatment |
| Nasals | m, ŋ(1) | m, ŋ (1) | m |
| Stops | b(1), g | d(1), k(2), g | g |
| Fricatives | h | h (4) | h |
| Affricates | | | |
| Glide/Liquid | | | |
| | articulation therapy | | |
| | Pre-treatment | during treatment | Post treatment |
| Nasals | m | m | m |
| Stops | g | b,g | b,g |
| Fricatives | h | h(3), j(2) | w (1) |
| Affricates | | | |
| Glide/Liquid | | | |

Articulation therapy proved most successful in increasing Sam's phonetic repertoire with the production of [b] post therapy. Other sounds were observed during therapy [h] and [j] but not post therapy. He also appears to have an additional sound [w] which he produced once post therapy.

Parent/teacher survey

Core Vocabulary Therapy

Sam's parents reported that although he didn't increase the number of sounds he used, he did use the sound that he had recently acquired, [m], "in a more effective and purposeful way." They also state that he has been "a lot more talkative" and that he was using some words clearly [gʌg] for book, [dɪŋ] for drink. His mother also stated "I was so excited when he started using these words unprompted."

His parents also report that although Sam didn't increase the number of sounds as he tended to "focus on the number of syllables" and "that's how he distinguishes one word from another." It was also stated that "I sometimes wonder if he purposely tries to copy the vowel sound whereas the consonants are too hard for him. His class teacher also agreed with this and reports "he has improved on making words sound differently – saying syllables."

His mother said that she did find it difficult to find the time to do the therapy but found that the support given was an "excellent motivator" and that "speech therapy is a real priority which it should be and make it part of the daily routine." She also stated that Sam "now understands (or is beginning to understand) the benefits of communicating through words rather than grunts and eye pointing."

Articulation Therapy

Sam's parents report that he is now making the [b] sound when asked but it sounds "forced". Also "as a side-effect (Sam) is very good at saying "mama" and uses it frequently, unpromptly, which is wonderful!" His mother goes further to state that "most of his talking I can't understand, but the "mama" is very clear."

Sam's teacher reports that he used [b] when prompted and continued to be aware of syllable structure in words and it was easier to understand him. Sam's mother reports that Sam "has not been able to combine "b" in words consistently, but comes very close occasionally" and that the "main difference is that he uses words to get attention, rather than growling."

Sam's parents had implemented daily speech exercises at home and that therapy "made a huge difference in progress made." They also stated that Sam "has become a lot more talkative." His teacher also stated that he has increased the amount of times he requests for things.

Communicative Intent

Sam's parents and teacher reported that he initiated more and was being understood more. The communicative intention worksheet (Paul, 2007) was completed (see Appendix E). The results show that after the first block of therapy, core vocabulary therapy, there were improvements in the areas of requesting actions and objects and commenting. When requesting an action Sam would not only use his AAC device but also request a turn by saying [mə gə] "my go". He also had begun to use words rather than gestures and vocalisations to request objects such as book and puzzle, which were target words in core vocabulary therapy. Sam was also beginning to imitate words more to comment on things rather than vocalising. There were no improvements after articulation therapy.

3.3 Rachel

Background Information

Rachel has been diagnosed with cortical dysplasia, epilepsy, global developmental delay, convergent squint and dribbling. She was ambulatory and was able to walk and run but occasionally would fall over. She had no feeding issues and ate a normal diet. She has had recurrent ear infections and had grommets in both ears. She experienced ear infections during the intervention and was often observed rubbing her ears. Rachel had her hearing tested whilst under anaesthetic in 2006, and was found to have normal hearing.

She had been attending the special needs school for six months prior to the start of intervention. Whilst being at the special needs school Rachel has received regular speech and language therapy, physiotherapy and occupational therapy alongside her educational programme.

Rachel has had previous speech and language therapy prior to starting school which focused on pre-verbal communication skills. She was beginning to use some Makaton (1998) signs and vocalisations. She had limited attention and fixated on specific activities. Since starting school she had been working on developing her attention and expressive communication skills. She had just been introduced to her AAC device.

Pre-intervention Assessment

Rachel was assessed for all areas of communication. Table 3.5 summarises the results of the pre-assessment. Most assessments were difficult to complete due to Rachel's attention levels being very limited.

Table 3.5 Pre-assessment results for Rachel.

| Assessment | Outcome |
|--|---|
| Informal Oro-Motor | <ul style="list-style-type: none"> ▪ Rachel appeared to have a wide range of oral function. ▪ She did appear to have difficulty moving her tongue tip to the right when this was out of her mouth. |
| Speech | <ul style="list-style-type: none"> ▪ Rachel used the following consonants [p, b, d, f, s, z, tʃ, h]. ▪ She used these vowels - [ɔi,ʌ, ə, ε, ɪ, i, aɪ,əi]. ▪ She used these sounds in v, cv, cvcv sequences, however, in general, there did not appear to be any consistency to the sequences. |
| Pre-verbal skills | <ul style="list-style-type: none"> ▪ Rachel was developing in most areas of pre-communicative behaviours, informal communicative and formal communicative skills. ▪ She appeared to be having more difficulty with music and singing and manipulation of emotion, however these tended to be emotions which were negative such as hitting in order to hurt someone or acting silly to provoke a reaction. ▪ Rachel was good at attention seeking and satisfying her needs and was able to indicate refusal. ▪ She was improving on her vocal and motor imitation and understanding of non-vocal communication such as, taking another person's hand when held out to her. |
| McArthur Bates Communicative Development Inventories | <ul style="list-style-type: none"> ▪ Rachel understood 61 words including those on subject areas such as vehicles, toys, body parts, furniture, household objects, people, games, routines, action words, descriptive words and the pronoun "mine". ▪ She used four words and signs two. These were - car, more (spoken and signed), yes, shoe (said once) and signs for twinkle twinkle. |
| Receptive and Expressive Language | <ul style="list-style-type: none"> ▪ Rachel was on the 1st percentile of the PLS4. ▪ She was able to understand specific phrases such as "play patty cake", and follow routines with cues. ▪ She played appropriately with some objects. She had more difficulty identifying pictures of familiar objects, which may have been due to her being distracted by turning over the pages of the book. ▪ Expressively Rachel vocalised without other movements, played with another person for up to two minutes and initiated turn taking games. She did have more difficulty with specific sounds and imitating words. |
| Observations | <ul style="list-style-type: none"> ▪ In structured situations, Rachel vocalised to gain attention. ▪ She signed for her favourite things such as twinkle twinkle little star and signed for toilet to leave the room. ▪ She interacted with other children, however this was largely to take things off them. ▪ Rachel was easily distracted when the attention was not on her. ▪ She flapped her hands when it was her turn and was able, with full assistance, to use her AAC device. ▪ Rachel tended to vocalise when interacting with others rather than randomly. |

Intervention

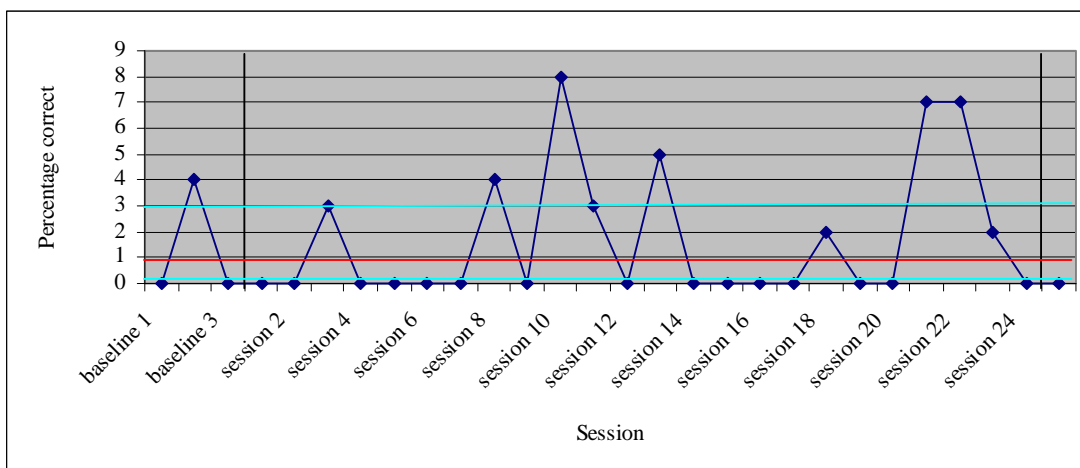
Rachel was randomly chosen to participate in articulation therapy first and then core vocabulary therapy. She took part in all of the sessions including baselines and class/home videos.

Throughout the blocks of therapy Rachel sat with a seat belt on her chair to reduce the amount of times she would go to the video camera which she was captivated by. Her attention was also very limited and she was placed on Ritalin in the second week of the first block of therapy and was taking an increased dosage in the second block of therapy. This appeared to have limited effect on her ability to attend to an adult directed task. She was often distracted by her environment. In the small room she would become distracted by the sliding door and would often turn in her chair to try to open and close it. In the other room if someone came in or was in the room behind this one she would sometimes be distracted and then become distressed.

Articulation therapy

Rachel received articulation therapy first. This focused on [m] as this was deemed the most appropriate sound to work on. Extra cues such as using [⊙] before and after [m] production were encouraged, however Rachel tended to just use [⊙] and not [m]. As can be seen in figure 3.9, Rachel was able to achieve [m] one percent of the time over the baselines. She was able to produce [m] one percent correctly during intervention. Exceptions of this were observed in sessions 10, 21 and 22 where she achieved eight and seven percent correct respectively. The results show that Rachel made significant during intervention. This may have been due to her being able to focus more in these sessions, however it may well have just been chance. The final baseline shows that she was unable to produce [b].

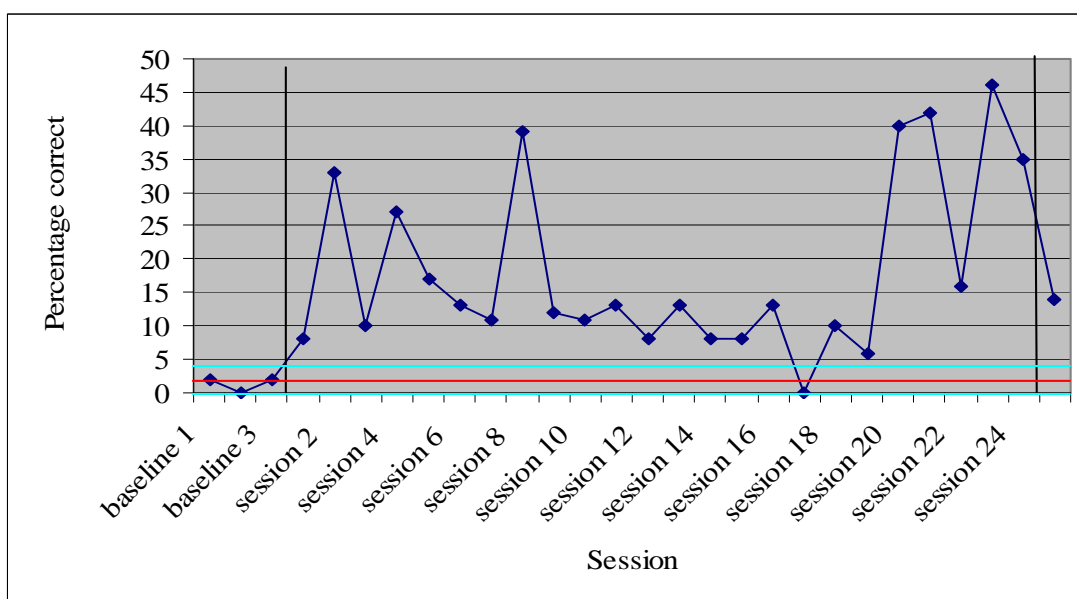
Figure 3.9 Percentage of [m] spoken correctly in isolation per session.



Core Vocabulary Therapy

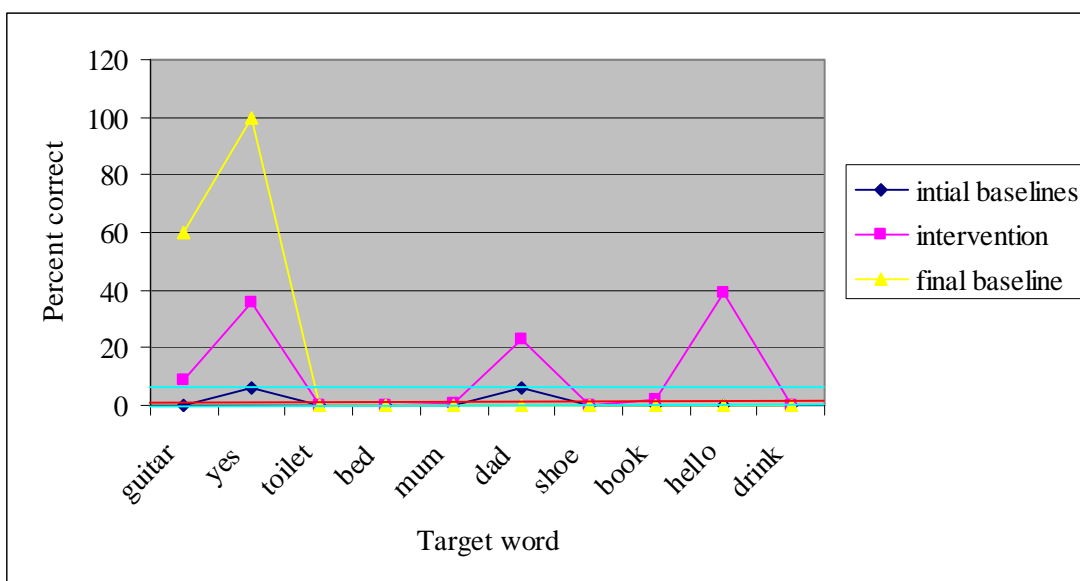
Rachel focused on 10 target words with two new words being introduced per week. The target words were carried over into the next week to work on maintenance. Rachel was prompted throughout the therapy and baselines to produce the target word and to attempt to maintain her attention on the task.

Figure 3.10 Percentage of accepted form of target words per session.



Rachel was able to produce the accepted form of the words in two baselines one percent of the time (see Appendix D for accepted forms). The standard deviation was analysed from the baseline results. Throughout intervention Rachel produced approximately 18 percent of the words. Seven sessions produced higher percentage of words correct which may have been due to Rachel being more familiar with the words. Four of the seven sessions were also the final session of the week which could also indicate that Rachel had learnt these words. The final week involved encouraging more spontaneous use of words, therefore Rachel was using words which were consistently easier for her such as ‘yes’. There is a decrease of 21 percent in the final baseline compared to the last session, which could be due to the break in therapy. Figure 3.10 shows that these results are significant.

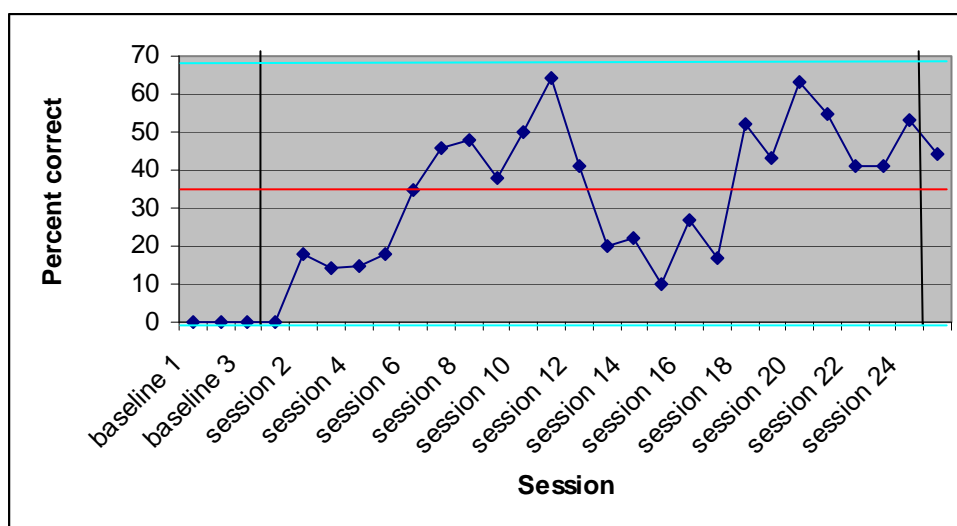
Figure 3.11 Total percent correct of all sessions per target word.



A further analysis of word by word production was carried out to understand the changes that occurred. Figure 3.11 shows that the results were not significant. At baseline Rachel was only able to produce some response to two words which were “yes” and “dad”. The standard deviation was taken from the initial baselines. She produced approximately 11 percent of the target words during intervention. Four out of the ten target words showed

significance during intervention, although there was some inconsistency of production over the sessions. These are “guitar” [tɑ], “yes” [i], “dad” [dɑ] and “hello” [hə.ɪ.əʊ]. However, only “guitar” and “yes” were maintained significantly a month after intervention. Rachel was the most consistent with the word “yes”. Rachel also produces [dɑ] when verbalising throughout the day, however she did appear to say it when looking at a picture of her dad purposefully on some occasions during therapy.

Figure 3.12 Percent of signs used per session.



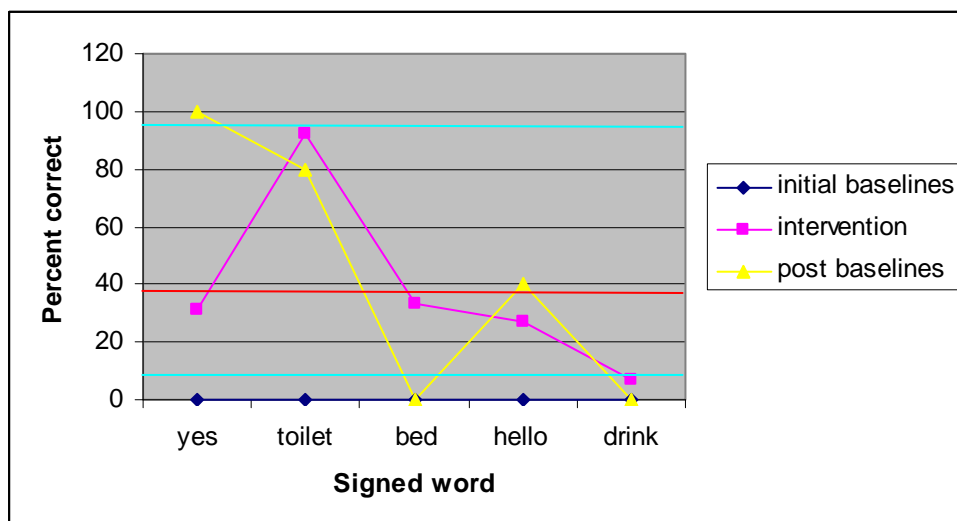
Rachel was exposed to signs for five out of the ten target words. Figure 3.11 shows that Rachel was signing approximately 34 percent of the words. She was able to achieve over 60 percent in sessions 11 and 20 which could be due to Rachel becoming more familiar with the signs. There is a decrease in the graph after session 11. Therapy stopped for two weeks after session 12 due to the researcher being away, this could account for part of this drop. Also three of the signed words were presented in the first two weeks and the final two signed words were presented in week five.

Sign by sign analysis, as seen in figure 3.13, shows that Rachel was able to achieve 38 percent of signs. The results were not however significant. Rachel was able to produce the

signs for yes and toilet, 100 percent and 80 percent correctly in the final baseline. She also developed bed and hello during intervention. The signs for “yes”, “toilet” and “hello” were maintained one month after therapy.

Her way of communicating “toilet”, “drink” and “bed” were by sign only. She would at times sign “toilet” to avoid taking part in therapy sessions and class sessions as she would not actually go to the toilet.

Figure 3.13 Total percent signed per target word.



There was limited improvement of the non-target words. She said an acceptable form of five out of ten words, which included her most used vowel [ɔ] to say on and off. These words were only said once or twice in the final baseline. [ɔ] was accepted as off which she said 100 percent of the time in the third initial baseline but only 20 percent of the time in the final baseline.

Phonetic Repertoire

The table below shows that Rachel used a wide range of sounds, however these were produced inconsistently. Production of [ɹ] did become more consistent after articulation therapy, however no other sounds improved after either therapy.

Table 3.6 Changes in phonetic repertoire for Rachel.

| articulation therapy | | | |
|-------------------------|-----------------|-------------------------|----------------|
| | pre-treatment | during treatment | post treatment |
| Nasals | m (2), n | m(14), n | n |
| Stops | p, b, (2), d, g | b(2), t, d, g | d, k |
| Fricatives | f, s, z, tʃ, h | s, z, ʃ, (1), tʃ (1), h | s, z, ʃ, tʃ, h |
| Approximant | | | w, ɹ, j |
| Glide/Liquid | | | |
| core vocabulary therapy | | | |
| | pre-treatment | during treatment | post treatment |
| Nasals | n | m(1), n | n |
| Stops | d, k | p, t, d, k(1), g | t, d, k, g |
| Fricatives | s, z, ʃ, tʃ, h | f (1), s, z, h | s, z, h |
| Approximant | w, ɹ, j | ɹ, j | ɹ |
| Glide/Liquid | | | |

Parent/teacher survey

Articulation therapy

Rachel's parents reported that they were unsure whether this therapy did increase her sounds but thought that she was verbalising a lot more. They also stated that she "is using her hands with intent – though she doesn't know anymore signs." They also report that she was giving more eye contact and her class teacher reported that she was looking more closely at

people and their mouths when they were talking. Her class teacher also stated that she was verbalising a lot more and was singing and signing “a bit more”.

Core Vocabulary Therapy

Rachel’s parents were unsure if the therapy had made an impact on her speech sounds. They did report that she did “stop saying “hello” for several weeks - she still is not longer saying hello for music session (we are using the “talker”). “Hello” was still used as a target word as Rachel did not appear to use it at school or during the pre-baselines. Her class teacher reported that she was “using more words and sounds and using them in the correct contexts. For example she would say her name when wants the object you are holding.”

Rachel’s parents stated that her “passive language” had increased and described this as doing actions to songs and playing appropriately with toys and doing household actions such as “taking the tea towel from the kitchen to the washing machine.” Rachel’s teacher reported that in class she was singing a lot more and “talking” while writing. Her teacher also stated that Rachel was initiating more and attempted to copy what is being said.

Rachel’s parents did report that she signed for drink on occasion and reported that her babysitter has noted more eye contact. They did however find this therapy more difficult “as hard to break words down and sign sounds.” They did state that “containing her” to a specific area was helpful to gain her focus and in the sessions at school this was also noted as Rachel was far more focused when she had her lap belt done up when sitting on her chair, rather than undone which led to her cruising around the room and spending a lot of time focusing on the video camera.

Communicative Intent

Rachel's parents and teacher do comment that she increased her ability to initiate and was talking and attempting to sign more post intervention. The communicative intent worksheet (Paul, 2007) was completed (see Appendix E). The results show that Rachel made improvements with her communicative intent.

After receiving the first block of therapy, articulation therapy, Rachel began to request song [əʊp] for open shut them. This was also maintained after the second block of therapy, core vocabulary therapy. Core vocabulary therapy appeared to have the biggest impact on her communicative intent. After this block she started to request objects such as "guitar" [tɑ] more consistently. She was also observed in the final week of therapy to say [nəʊ/ nə] four times to refuse objects rather than just push them away or vocalise to show frustration, which had not been observed previously. Rachel answered with some of the target words when asked what she wants. She signed for "toilet" consistently and said [tɑ] when asked if she wanted the guitar or the drum. Rachel had begun to acknowledge others and responded with "hello" [həʊəʊ] when someone said hello to her more consistently than pre-intervention.

3.4 Summary of Results.

The results show that there have been changes with all three children after therapy. The analysis of the results proved to be slightly different for each child. Jack was unable to produce any of the sounds or target words during the baselines. Therefore the two standard deviation was taken from the intervention. Sam did not produce the target sound at baseline, therefore two standard deviation was taken from intervention. However he was able to produce the correct syllable structure at times in the baseline for core vocabulary, therefore the two standard deviation was taken from the baseline. Rachel was able to produce both

some words and the target sound during her baselines, therefore the two standard deviation was taken from both the baselines, with the exception of analysing her signs which was taken from the intervention.

- *Articulation therapy* – Jack showed improvement in his production of [f] but this was not significant. Sam showed significant improvement when analysing production of [b] in isolation and with another consonant. Rachel achieved significant change during therapy but not post therapy, however she did only achieve eight percent correct at most.
- *Core Vocabulary Therapy* – Jack significantly changed the amount of target words spoken with correct form. He showed significant change in four out of 10 words, however analysing the percent of words spoken per session showed that the results were not significant. Sam showed significant changes however towards the end of the block of intervention this was not maintained. He found two syllable words easier to produce. Rachel showed improvements in four out of 10 target words which was significant. Her total percent correct of words during the sessions was also significant. There was no significance in her level of signing. However, she did maintain the signs of three out of five words after therapy.
- *Phonetic repertoire* – Jack and Sam showed a change of at least one sound post therapy after articulation therapy but none after core vocabulary therapy. Rachel's phonetic repertoire showed inconsistencies, however neither therapy appeared to have made an impact on her phonetic repertoire.
- *Communicative Intent* – All of the children showed improvements in their communicative intent after core vocabulary therapy and limited, if at all after articulation therapy.

Discussion

4.1 Summary of Results

This study evaluated the effects of two forms of therapy on the phonetic repertoire of children with multiple disabilities. It also focused on the changes in communicative intent. A section below will be dedicated to differences in disabilities and the possible effects that these had on intervention. There were 2 hypothesis:

- 1) *The phonetic repertoire of children with multiple disabilities will improve after traditional articulation therapy and core vocabulary therapy.*
- 2) *The communicative intent of children with multiple disabilities will improve after a combination of traditional articulation therapy and core vocabulary therapy.*

Effect of articulation therapy treatment on phonetic repertoire

Each child showed improvements in their phonetic repertoire during therapy. Two of the three children made significant changes during intervention. Although there appears to be significance in the results, the percentages of total correct post therapy need to be stated. Rachel was unable to produce [m] post baseline, Jack produced [f] with one full breath above two standard deviations post baseline and Sam produced [b] two standard deviations post baseline when the results of [b] in isolation and [b] in a consonant consonant (cc) structure are collaborated.

Rachel achieved significant changes during therapy, however she was only able to produce a total of eight percent in one session compared to Jack and Sam who could produce their target sound on occasions over 30 percent. She also only managed to produce [m] a total of 15 times during 28 sessions (including baselines). Rachel did have very limited attention during the intervention and would often rub her ears indicating an ear infection, which she was on antibiotics for. She was also taking Ritalin, with no obvious effect on her attention

levels. This therefore indicates, that she may not have been ready for this form of therapy and pre-verbal skills such as attention and listening may have been more beneficial or finding other ways to present the material.

Sam achieved positive changes during therapy when he put [b] in a cc structure. He achieved [b] in isolation above two standard deviations once during intervention however in the final baseline only achieved six percent success. Sam exhibited excessive muscle tone and tension and struggling behaviours were seen on his face and whole body during this intervention which is characteristic of dysarthria (Duffy, 1995; Workinger, 2005).

Jack's results were not significant. This is interesting as when looking at the data he consistently showed improvement in his production with a final baseline of 33 percent which is above the two standard deviations. There are limitations to this study which will be discussed later, however the impact of only one final baseline can be clearly seen here as if there were three final baselines Jack may well have achieved significant results. He also had less therapy due to his seizure in the third week and his final baseline was seven weeks post therapy. Jack often produced [f] with two or more breaths, which could be his way of producing the sound, however this was not accepted when analysing the results but does need to be noted.

Results of previous studies can be compared to the results found here. Marchant et al (2008) and Wu and Jeng (2004) both found positive results of articulation therapy with children with CP with mild to moderate intellectual disabilities. Both of the children with CP made improvements to their target speech sound with articulation therapy. Jack was also developing [f] in cv and cvcv structures which compares to Marchant et al (2008) as they also found that phonetic placement did improve their participants speech intelligibility in single words. However the differences between the children in this study show that they not only had severe delays in receptive and expressive language but also very limited phonetic

repertoires, which consisted mostly of plosives and nasals. Therefore the question arises which would be best to work on first – articulation to enable the child to have more speech sounds therefore giving a higher chance of intelligible words or vocabulary which will give the child the words to speak? As can be seen with Rachel she does have a comparably large phonetic repertoire. Working on her speech sounds had little gains on increasing this further and making these sounds meaningful to her, as she was already able to get her needs met through non verbal communication, although her parents did find that she was verbalising more post therapy.

Jack and Sam's phonetic repertoire do appear to follow with what previous literature has found in that they have limited use of sibilants/fricatives (Wilson, 1966) and appear to be unable to produce [t] or [d] (Crickmay, 1966; Fogle, 2008; Van Riper & Erickson, 1996). Interestingly, Jack, who is blind, has a phonetic repertoire made up of those sounds which are seen, such as [p], [b], [m]. This is different to the findings of Mills (1983) who found the child who was blind learnt these sounds later. There are marked differences to the child in Mills (1983) study and Jack, as he has the additional disabilities of CP and intellectual disability as well as epilepsy.

Studies on children with intellectual disability and articulation therapy (Sommers et al 1970; Wilson, 1966) have been inconclusive. The results in this research do show that articulation therapy can improve the phonetic repertoire of some children with additional intellectual disabilities, although some of the results were not significant which is similar to Wilson (1966). The intensity of the therapy also could have had a positive impact on the results for Jack and Sam, as was found with Sommers et al (1970), however there was no control in this study to compare for levels of therapy provided.

It is difficult to assess the usefulness of cued articulation as none of the children attempted to copy these actions. Jack, who was blind and hypersensitive around his face,

physically resisted feeling the sound by pushing away the researcher's hand. Sam was also limited in his fine motor skills therefore attempting the actions may have been more difficult. Rachel was the most likely to have benefited from this and her parents did report that after articulation therapy she had started to use her hands with intent.

Phonetic placement does have positive effects for these children as they all, at some point were able to achieve the correct placement of the sound. Jack was able to achieve correct placement but without the target sound. Additional assistance, as suggested by Bleile (1995), including using wooden spatulas and food was successful with Sam however Jack was resistant to this and refused to touch the wooden spatula in the oral motor assessment. Rachel was encouraged to make the [⊙] sound and either precede or follow this with [m], she was successful in making this sound but was unable to join it with [m].

Effect of core vocabulary treatment on phonetic repertoire

Core vocabulary therapy had no impact on increasing the phonetic repertoire of any of the children in this study as it has in previous studies (Dodd & Bradford, 2000; Scherer 1999). Nevertheless there were improvements seen in all of the children. Jack and Rachel made some of the target words with a more consistent structure which is consistent with the literature on this intervention (Dodd et al 2006; Dodd & Bradford, 2000; Holm & Dodd, 1999). Rachel developed more consistent signing in three out five Makaton (1998) signs. Of the five signs two were used with the spoken word and one was just signed up to 80 percent in the final baseline.

Jack consistently changed 50 percent of the words he used, four of these being at 100 percent correct and one being at 80 percent correct in the final baseline. He did show changes above the two standard deviation in the total percentage correct in the second session and final baseline. Rachel's results proved to be significant during intervention and she was most

consistent with three spoken words. One was at 100 percent at the final baseline, one was at 60 percent but she was unable to produce the other at final baseline, although achieved some success during intervention.

Sam produced all words with the use of [gə], [əg] or [gə gə] and on occasion produced Michaela with (məgəgə]. Therefore due to his very limited phonetic repertoire and difficulty using any other consonants his understanding of syllabic structure was analysed. He developed his skills at this and achieved 60 percent success of all two syllable words spoken. This achievement was mostly significant at the start of intervention and as the number of words increased his success decreased. This could be related primarily to the dysarthric qualities of his speech which have made production of sounds difficult due to limited motor control and tension exhibited when producing sounds.

The cognitive load also had an impact on Jack, as he was able to achieve higher than the two standard deviations during intervention in the first week of therapy and then in the final baseline. Both Jack and Sam showed that when each new set of words were introduced the percentage correct went down before rising in the next few sessions. This was also seen with Rachel who increased her percentage correct in the third and fourth session of each week.

There has been some speculation regarding the effects that core vocabulary therapy has on children with receptive language impairments and global developmental delay (Scherer, 1999) as well as those with articulation disorders (Dodd & Bradford, 2000). This research has attempted to answer some of this speculation and the results are generally positive. The children in this study may not have gained consistent correct pronunciation of words, with the exception of Jack and his production of “off”, but it has shown that this approach can be used to gain constant word and syllable structures for the target words for children with multiple disabilities. This study also highlights the difficulties that these

children face when attempting verbal communication and the strategies that they may use. It also highlights the benefits of therapy to the families and teachers.

Effect of intervention on communication intent

The results from the parent and teacher interviews and from the video analysis of the children in their class and home settings showed that there has been an improvement in their communicative intent. Interestingly core vocabulary therapy had the most change on all of the children's intentional communication. This could be due to them being more understandable in their intentions by using a form of the target word or correct syllable structure. Articulation therapy had little impact on the communicative intent of the children, although Rachel was seen to use her hands more and vocalise more and Jack did become more talkative.

The improvements on communicative intent appeared to be on requesting objects, particularly those that were used in therapy. Jack made improvements by becoming more spontaneous with his words rather than being prompted and Rachel was beginning to use 'hello' [hə.ləʊ] more. Sam became more understandable by attempting the correct syllable sequence which in turn made the words he was attempting different therefore more recognisable.

These results are similar to those found by Mclean and Snyder-Mclean (1991) in that all of the children were at the proto-imperative stage where they were requesting objects and actions and are protesting but they are also developing skills at the proto-declarative stage where they were gaining another's attention to get something. This was seen with Sam and his use of 'mamma' to gain his mother's attention to what he wanted and Rachel went up to people to get them to get things that she wanted.

Jack appeared to be limited in this area, which could be attributed to his blindness, as when he was on his own, he focused on the things around him or would sing to himself rather than interact with an adult spontaneously. This supports the research analysis conducted by Fazzi et al (2003) who also found that children with LCA were likely to have a wide vocabulary, as Jack did, but they did not always use it with intent. However, when the adult had initiated the interaction Jack responded and requested for items. Jack was able to learn routines and gained an adult's attention after morning tea to ask for his AAC device so that he could choose what he wanted to do next. This corroborates with the findings of Iacono et al (1998) who found that two children with multiple disabilities and visual impairment were often intentional when they were in familiar routines.

Differences noted in the differing disabilities and how this relates to the results.

Children with multiple disabilities are unique in the potential difficulties that they face. This study shows that generalising the population is not viable due to the varying disabilities and the effects that these have on communication. In spite of this, therapy which is used with children, who have delays in their speech or language but no other disabilities, can be used and adapted to suit these children. They can also gain similar benefits as those of normally developing children, yet these will be at a slower rate and may not be completely functional and need assistance in their communication with AAC therefore becoming multimodal communicators (Allaire et al, 1991). Some of the differences that could have contributed to the discrepancy in the results between the children include; attention, ear infections, epilepsy, spastic cerebral palsy and visual impairment.

All of the children needed their attention refocused at points back to task. Rachel's attention was the most limited and was compounded by her recurrent ear infections which could have impacted on the results. When compared to Jack and Sam, Rachel does have a

large phonetic repertoire. As noted above she is developing her understanding that sounds and signs can be used to get what she wants. Therapy therefore may need to be re-evaluated to look at potential techniques of improving attention and increasing her speech and language development.

Sam had the most significant motor disorder secondary to his CP. This can be clearly seen in the struggling behaviours and tension that he exhibited when attempting sounds, however he did still manage to achieve [b] in isolation. He would require further therapy which focused on breath control (Pennington, 2008; Pennington et al 2006; Workinger, 2005) and relaxation (Marchant et al, 2008) as well as continuing on building his current sounds in isolation and cv, vc, cvc and cvcv sequences.

Visual impairment does have an impact on a child's communication skills. Jack's intentional communication appears the most affected, in particular, attracting other's attention to objects around him. He has however, achieved the most during intervention, although his results appear to be not significant, with regards to consistent production of [f] in one breath over the intervention and final baseline. He had more consistent production of the target words to five out of ten words. It has been valuable to look at how to present the targets in therapy and of interest to note how using cued methods such as touch as recommended by Elstner (1983) have been unsuccessful due to Jack's hypersensitivity around his face. The auditory awareness, also suggested by Elstner (1983), proved to be more successful.

Jack also had epileptic seizures in both blocks of therapy. Luckily the seizures did not appear to have an impact on his speech and language functioning after his seizures, which supports the findings of Toueg (2002). He did however miss up to seven weeks of school after both seizures which could impact on his learning. It was interesting that he had a further seizure in the second block of therapy after three weeks once again. It is hoped that intensive speech and language therapy does not bring about increased chance of seizure activity.

4.2 Clinical Implications

There is limited research on working with children with multiple disabilities. Therefore this research, along with other studies (Marchant et al, 2008; Pennington et al, 2006; Sommers et al, 1970; Wilson 1966; Wu & Jeng, 2004;) has gone some way at finding ways to improve the speech of children with multiple disabilities. This study has raised issues with regards to working with these children.

Intervention

Children with multiple disabilities may need to use a multimodal approach, as discussed by Allaire et al (1991) to communication. Therefore assessing the individual child and their communicative needs is essential. There may be benefits of combining therapy that focuses on verbal output as well as that which focuses on other non-verbal skills such as attention and head and neck control (Workinger, 2005) and breathing techniques (Pennington et al, 2006; Workinger, 2005) if the child has difficulty with any of these areas.

As has been seen with the children in this study their phonetic repertoire has increased in two out of three cases. Therefore this does imply that articulation therapy can be seen as a therapeutic approach for working with children with complex communication needs. Core vocabulary therapy has been seen to increase understanding of how words are formulated and can increase the communicative intent, which supports the literature (Dodd & Bradford, 2000; Scherer, 1999). By focusing on a select number of words, the children in this study are now using some of them in everyday situations and are becoming more intelligible to those around them even if the words they are saying are not phonetically correct.

A combination approach may prove beneficial, particularly if some or all of the target words of core vocabulary therapy were those which had the consonants, word initially, which

were already in the child's phonetic repertoire. This would enable more success for the child and would also continue to work on developing speech sounds.

This study shows that speech is still an aim for children with complex communication needs. They may still require assistance with everyday communication using AAC methods (Alliare et al, 1991; Beukelman & Mirenda, 2005; Millar et al, 2006; Marshall & Goldbart, 2008; Pennington, 2008). Therapy has proved to be rewarding for the families and the children as there have been improvements in their communicative function. Therefore working on AAC alongside therapy that focuses on verbal output would be beneficial as Beukelman and Mirenda (2005) suggested.

This study has shown that ongoing intensive therapy has also been useful, which Sommers et al (1970) predicted. This can particularly be seen when the researcher was away for two weeks and there was a decline in success which was then improved upon once therapy resumed. Therefore where possible, the SLT, with the assistance of parents and teaching staff, could provide an intensive intervention programme. This would need to require ongoing reassessment and an awareness that therapy with children with multiple disabilities may take longer than with children who have delays in their speech or language but no other disabilities (Pennington, 2008).

4.3 Limitations to this study

Although this study has found positive implications for articulation and core vocabulary therapy on the phonetic repertoire of children with multiple disabilities, a number of limitations existed. As with many studies of children with multiple disabilities (Iacono et al 1998; Kekelis & Anderson, 1984; Marchant et al, 2008; Mills 1983; Moore & McConachie, 1994; Pennington et al, 2006; Stephenson & Dowrick, 2005; Wu & Jeng 2004) there were only three children involved, therefore these results cannot be generalised to this population. However as this population is heterogeneous it is difficult to generalise these results, as each child should be seen as an individual with individual needs and strengths.

A major methodological limitation in this study is that there is only one final baseline post therapy, if this study was to be replicated then three baselines would need to be taken. Also it would be beneficial to target the sounds and words a set number of times during intervention therefore making the results more consistent. However this can also be difficult to do in the clinical situation as children may or may not be responsive and therapy has to be adapted to each child on each day, as this can vary, especially if the child is non-compliant, has limited attention and is not feeling well.

There is also some researcher bias in what the accepted form of the target words were. There would be a need for familiar and non-familiar listeners to establish what would be the most accepted forms of target words to control for any bias that may occur. However, when relating this to clinical practice the SLT has to make on the spot decisions regarding this. This is why it is essential to work in collaboration with the families and professionals that work with the child to establish what is accepted and can be generalised to everyday situations.

Another potential limitation was with core vocabulary therapy. The target words were presented two at a time and then practised the following weeks to achieve maintenance. A

further two new target words were introduced each week, which did increase the cognitive load on the children. It may have been beneficial to target just two words per week, as described by Holm et al (2005), and if these were not consistent at the end of each week then they were put back and two new target words were selected. This could be trialled if this study was to be replicated to see if it is more advantageous to maintain focus on just two words rather than increasing it to 10 words by the sixth week. Another option would be to focus on the words until the child reaches 80 percent consistency before a new word is introduced.

The length of therapy could have had an impact on the final results. The intensity was appropriate at four 20-30 minute sessions per week. However it is likely that the children would have benefited from ongoing intensive therapy for a longer period rather than just six weeks, as suggested by Sommers et al (1970). This could include focus on target sound/words per term, which tends to be 10 weeks in New Zealand (Ministry of Education, nd). However this also has clinical implications depending on the number of children on an SLT's caseload and whether this intense treatment is viable.

Although most of the feedback from parents and the teacher were positive regarding therapy, a limitation could have been the amount of contact between the researcher and the child's family. Each family and teacher was given a handout on how to provide therapy and any questions that arose throughout the intervention were answered. It may however, have been beneficial for the families to sit in on a session or watch a video of how to do the therapy therefore allowing the therapy techniques that were used to be correctly implemented at home. Although this depends on the child's co-operation as Jack's family did find that he was reluctant to take part in any form of practise at home. Teachers and teacher aides could also have been in the sessions to allow for implementation within the classroom.

The analysis of the results were also of interest as some results were analysed from the baseline and some from the intervention due to there being no production of target sound or word during the baseline. This therefore may have shown that some results appeared to be more significant when compared to results analysed during intervention.

This study does highlight the issues of reliability with individuals with multiple disabilities. Other research that has focused on the sensory perception of children with profound intellectual and multiple disabilities found reliability which ranged from 48% to 63% agreement when conditions were controlled. However there was a higher rating of 54% to 84% agreement when these conditions were not controlled for (Vlaskamp & Cuppen-Fontaine, 2007). There are a number of factors to consider when looking at the reliability which include; unfamiliarity of children to the SLT; only having one rater; only providing guidance to transcribe the speech of the children; difficulty in hearing some of the videos due to background noise from other students at the school, which the researcher was unable to control, and at times it is unclear if the child is making an attempt on the target word/sound or if they are just vocalising. The reliability would need to be analysed and changed if this study was to be replicated. There would need to be a more structured outline to the analysis as the main discrepancy found in the reliability was between the vowel sounds. The SLT would need to be trained in the phonetic productions that some of these children produce, as their sounds appear to fall outside the categories that are taught within basic training of phonetic transcriptions. It would also be beneficial to have more than one rater. The ideal for future study would be in a sound proofed room, however these are situations that SLT's have to deal with on a regular basis and are not within their control.

4.4 Future Research

There is a need for further research as there are a limited number of studies which focuses on providing speech and language therapy for children with multiple disabilities. This research has shown the value of providing traditional therapy with these children and they have developed some speech sounds and consistency amongst some words.

It would be useful to see if a combination of both therapies could be implemented and successful. All of the children, as with many others with multiple disabilities use AAC (Alliare et al, 1991; Beukelman & Mirenda, 2005; Marshall & Goldbart, 2008; Millar et al, 2006; Pennington, 2008). Therefore it would be important to continue the research into this as it has been reported that AAC is not always supported by families as they prefer to use the child's verbal output and fear that AAC may stop them talking (Beukelman & Mirenda, 2005). Including the use of AAC with articulation therapy and core vocabulary therapy could improve not only the child's speech as has been found previously (Millar et al, 2006) but also to encourage the views of families with children who use AAC.

Another issue which has arisen from this study is the communicative intent of children who are visually impaired (Fazzi et al, 2003; Iacono et al, 1998). As has been seen from the results, both of the sighted children attempt to gain another's attention through actions and verbalisations. However the child who is blind did not attempt this during videoing. It would be important to look at communicative partners in the child's life and their interactions, not only with those with visual impairment but also with children with varying disabilities, and how these could be adapted to encourage more intentional communication.

Articulation therapy has been seen in this study and in others (Marchant et al, 2008; Wu & Jeng, 2004) to have a positive impact on the phonetic repertoire of two out of three children with multiple disabilities including CP. Core Vocabulary therapy has also had a positive impact on all of the children. Future research into both these areas is essential to

discover what the implications are, for children with a variety of differing disorders and disabilities. This should also include the use of assistive techniques such as cued articulation and phonetic placement.

Further studies regarding the length of treatment and whether ongoing treatment is necessary and successful is also important. In this study, changes can be seen in the second block of intervention where there appeared to be a dip in two of the children's success after a two week break. This study also supports Sommers et al (1970) in their proposal for more research into therapy length.

4.5 Summary and Conclusions

The present study aimed to see if changes in the phonetic repertoire of children with multiple disabilities including; CP, CD, epilepsy, intellectual disability and visual impairment, could be made by articulation or core vocabulary therapy. It also focused on the communicative intent of these children and whether either therapy had an impact on this.

Whilst only two children made significant changes during articulation therapy, all of them achieved some success. In fact, both of the children with CP, one of whom did not achieve significant results, maintained improvements by saying the target sound up to 35 percent in the final baseline, where as the child with CD was unable to say her sound. However there was compounding factors which included her attention levels and co-operation in adult-directed tasks.

Core vocabulary therapy also had an impact on these children. There were no changes to their phonetic repertoire, as was hoped, but they did appear to improve on developing a consistent way to say the words. One of the children, Sam, was evaluated on his ability to use the correct syllable structure. This was due to his very limited phonetic repertoire. He showed significant changes at the start of the therapy but these decreased as the number of words increased. The other two children both made significant changes in their production of words. However due to methodological error of only having one final baseline it is difficult to conclude if the maintenance was significant. It is also of interest to note that Rachel did achieve some success with signing and was developing this. She was also signing and speaking two of the words concurrently.

The communicative intent did increase with all of the children after the core vocabulary therapy but there was limited change after articulation therapy. Therefore providing therapy that does work on speech and vocabulary can improve a child's intent to communicate with family and those around them.

It was interesting to find that the child who was blind and with CP and epilepsy, Jack, did have the greatest success with both therapies even though he had a seizure in both blocks of therapy and had fewer intervention sessions. The child who had CP with severe dysarthria, Sam, also achieved great success with his production of [b] and his understanding of how words are formed. Rachel who has CD, epilepsy, squint, recurrent ear infections and attention difficulties did show some improvements in particular with core vocabulary and her ability to sign. It is hypothesised that her attention and recurrent ear infections could well have had an impact on her ability to concentrate and focus on the sounds and words.

Further research is needed with this population including looking at the use of AAC and developing this alongside working on speech. In conclusion, working on a child's speech continues to be of value and success. It not only has been seen to develop their phonetic repertoire and vocabulary skills but also benefited the families who saw their child achieve some success. It is important therefore to assess each child with multiple disabilities and provide an individualised therapy plan that involves not only the family and the SLT but also the child's teachers and other health professionals including physiotherapists and occupational therapists.

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Appendix A

HEC Approval

Participants Information

Participants consent forms – Parents and Principal

Video consent forms

Ref: HEC 2008/9

20 March 2008

Ms Hannah Clements
Department of Communication Disorders
UNIVERSITY OF CANTERBURY

Dear Hannah

The Human Ethics Committee advises that your research proposal “Effects of articulation therapy and core vocabulary therapy on the phonetic repertoire of children with multiple disabilities” has been considered and approved.

Please note that this approval is subject to the incorporation of the amendments you have provided in your email of 19 March 2008.

Best wishes for your project.

Yours sincerely

Dr Michael Grimshaw
Chair, Human Ethics Committee

University of Canterbury

Speech and Language Therapy Department

INFORMATION

Your child is invited to participate as a subject in the research project:

Effects of articulation therapy and core vocabulary therapy on the phonetic repertoire of children with multiple disabilities.

The aim of this project is to determine if articulation intervention or core vocabulary intervention is effective at developing the phonetic repertoire of children with multiple disabilities including cerebral palsy, intellectual disability and visual impairment.

Your child will receive therapy including and in addition to the speech and language therapy that they are already receiving at school. The sessions will include individual sessions four times a week for 20-30 minutes, depending on their level of attention and enjoyment. These sessions will last for 6 weeks for each block of therapy with a 4 week break in the middle.

In addition to these sessions therapy techniques and specific sounds or words will need to be included in your child's home and school life for those 6 weeks.

The two interventions will be randomly assigned to your child so they may receive articulation therapy or core vocabulary therapy to start with.

Articulation therapy involves working on specific sounds e.g. k, t. Your child will have to complete listening tasks involving discriminating between different sounds. They will then be encouraged to produce the sound. They will be given verbal, touch cue and /or object cue prompts to help them know where the sound is made and how it is made.

Eventually sounds will be joined together.

Core Vocabulary therapy focuses on 10 target words, which will be discussed between you, the class teacher and the researcher. Once the words have been selected your child will be encouraged to listen and produce the words by a sound by sound approach to teach the words. Practise of the words will include syllable segmentation and imitation and then drills will be used to increase the number of times the child will say the word.

You have the right to withdraw yourself and your child from the project at any time, including withdrawal of any information provided.

The results of the project may be published, but you must be assured of the complete confidentiality of data gathered in this investigation: the identity of participants will not be made public without your consent. To ensure confidentiality your child will be called a letter e.g. K was able to produce.... The data collected will be kept at _____ School in a lockable cabinet, along with your child's therapy notes.

The project is being carried out as a requirement for a Masters Degree in Speech and Language Therapy by Hannah Clements under the supervision of Catherine Moran, who can be contacted on 03 364 2401. She will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed *and approved* by the University of Canterbury Human Ethics Committee.

Hannah Clements

CONSENT FORMEffects of articulation therapy and core vocabulary therapy on the phonetic repertoire of children with multiple disabilities including cerebral palsy and visual impairment.

I have read and understood the description of the above-named project. On this basis I agree that my child can participate as a subject in this project, and I consent to the publication of the results of the project with the understanding that confidentiality will be preserved.

I understand that I may withdraw my child and any information I have provided, from the project at any time.

NAME OF CHILD (please print).....

PARENT'S NAME (please print):.....

Signature:

Date:

CONSENT FORMEffects of articulation therapy and core vocabulary therapy on the phonetic repertoire of children with multiple disabilities including cerebral palsy and visual impairment.

I have read and understood the description of the above-named project. On this basis I agree that this research project can be undertaken at _____ School. I agree that the therapy can be part of the researcher's daily speech and language therapy programme provided to the participants who are taking part in this project. I consent that information from the participants case notes can be used, as long as there are no names given in the research.

NAME (please print):.....

Signature:

Job Title (please print):.....

Date:

Video Consent Form

1. I agree to my child _____ participating in the study titled
Effects of articulation therapy and core vocabulary therapy on the
phonetic repertoire of children with multiple disabilities.
2. I understand that the study sessions will be videotaped.
3. I do / do not give my permission for sections of this video to form part of training
materials presented to professionals working with children or trainee
professionals.
4. I do / do not give my permission for sections of this video to be shown at
academic or clinical conferences while reporting findings of the study.

Participant's name: _____

Caregiver/ Parent's name: _____

Signed.....

Date.....

Appendix B

Therapy information forms-

Articulation therapy

Core vocabulary therapy

The 'B' Workbook

We are working on the sound 'b' at school.

This is a workbook with activities that will help your child with the production of 'b' and can be done at home.

What you will need!

- ☺ ball for b and goose (toy) for g
- ☺ mirror
- ☺ Games like skittles or rewarding game to make sure it's fun!

Listening

We have been working on listening to the sound and finding out if your child can hear the difference between 'b' and 'g'. This is the first step in helping your child produce the 'b' sound.

Activities involved include:

- ☺ Using objects –ball for 'b' and goose for 'g'. We say one of the sounds and your child has to find the correct sound by choosing either the 'b' or 'g' object.
- ☺ Repeat the sound back of the object that they choose.
- ☺ If it is not the same as what you first said say "good try listen again 'b'/'g'. They may need to be redirected to the correct object.
- ☺ When your child has completed 10 correct choices move on to the next activity.

Production of 'b'

Your child is learning how to make the 'b' sound. Ways to help your child is by doing the following activities;

- ☺ Show your child how to say 'b' by closing your lips together then opening them and letting the sound come out.
- ☺ It is an idea to use cued articulation to give extra clues to what sound you are making.



- ☺ For 'b' you put your index finger and middle finger on your thumb and then place it to the side of your mouth and open as you say the sound. Encourage your child to do the same.
- ☺ Encourage your child to press their lips together, initially they don't need to make a sound. Use a mirror so that they can look at themselves or get them to feel their own mouths.
- ☺ You may need to touch their top then bottom lip and ask them to put their lips together to touch the place where you have just touched.
- ☺ When they are good at closing their mouths encourage your child to make the 'b' sound. Say "Lips together and make an 'b' noise", "that's a good try", "that sounds like 'b'". Allow your child to feel your nose when you make the

sound so that they can feel the vibration and then encourage them to feel their nose and make the sound.

- ☺ Ask your child to repeat the 'b' sound at least 10 times.
- ☺ Play games with this for instance, putting the objects under skittles and they have to say the sound when they knock down the skittle. Other games can include the posting box and your child has to say the sound before posting the object. Place objects beginning with 'b' in a bag and then take it in turns to pull out an object and say the 'b' sound.
- ☺ Use rewards for making the 'b' sound. Even if your child does not make the 'b' sound correctly they should have a reward for trying. You can use sticker charts, or play their favourite music or play with their favourite toy and so on.
- ☺ Once your child is able to say 'b' encourage your child to join it with a vowel sound e.g. ba, be, by, bo and boo. You can use objects which represent the sound e.g. sheep says 'baa', bed, bin, bath, book, bee, baby and bird. You can work your way around the house labeling things that start with 'b'. These are only examples you may have some other good ideas!

Practise

- ☺ Practise these activities for at least 5 -10 minutes a day at least 5 days a week.
- ☺ When practicing saying the 'b' sound encourage your child to repeat it at least 10 times.
- ☺ Encourage your child to ask for more using 'b' – therefore this can be reinforced throughout the day e.g. when playing with a toy such as bricks your child has to ask for 'b' more to get another brick, when listening to the radio/TV turn down the volume and your child has to ask for 'b' more to have the volume turned back up.
- ☺ Enclosed are some worksheets to fill in, please can you do this each time you work on 'b' with your child. If you can score the times she successfully listens to 'b' and says 'b' as well as when she is unsuccessful.

Good Luck!

If you have any questions please don't hesitate to contact me on _____

Hannah Clements
Speech and Language Therapists

Core Vocabulary Therapy

Your child is going to be learning a selection of 10 words over the next 5 weeks and will be receiving intensive speech and language therapy for 6 weeks. Initially your child will be learning 2 words and each week another 2 words will be added.

The aim of this is to see if your child can develop his speech sounds and see if he can produce the words consistently.

How you can help

In the therapy sessions we are breaking each word down to each sound e.g. book would be "b u k". To support this we are also using cued articulation which is a series of hand movements which give your child a clue on how to make the sounds and word.

Encourage your child to copy the cued articulation and say the sounds in isolation. Try this 5 times for each word – you can write down what he says.

Next try clapping out the syllables – e.g. book has 1, puzzle has 2. You can bang a drum to make this more fun. Encourage him to listen to how many times you bang the drum to guess which word you are focusing on you can even give him the first sound by using cued articulation. Then he has to bang the drum and you have to guess what word he is trying to say.

Play games such as skittles where you place puzzle pieces or books under the skittle and every time he knocks one over he has to tell you what it is and either put the piece in the puzzle or you read him a page of the book. You can also play what's in the bag where you put puzzle pieces and books in a bag and he has to pull one out.

Encourage your child to attempt the words at least 10 times per session. Sessions can be from 10 – 15 minutes long and if possible daily.

Please can you fill in the below tables of what your child is saying and how they are saying it.

If you have any questions, please don't hesitate to contact me on _____ or _____

Hannah Clements
Speech and Language Therapist

CUED ARTICULATION

PUZZLE



p – close index finger to thumb and open when say the sound.



u – do short jerk of hand up to show that it is a short vowel.



z – as you make the z sound move hand forward in zig zag line.



(as in or)- move the hand back four inches to show a long vowel.



l – this is the start of the l sound. The fingers may actually help push the tongue up and back. As the tongue moves down to make the sound move the wrist down in a small semi-circle.

Appendix C

Parent/teacher survey forms

Summary of therapy

Name:

Therapy type:

Block:

1) Did the therapy that your child received improve or increase the number of their speech sounds? Can you give me some examples of this.

2) Has your child been more talkative during or since receiving the block of therapy? Can you give me an example of this.

3) Have you noticed anything else with regards to their communication that has changed during or since receiving the block of therapy?

4) Have you noticed that your child is initiating more or are they only responding to what you say?

5) Was it easy to implement the therapy at home? If so, why? If not, why not?

6) Are there any changes that you would make to help your child in developing their communication including increasing the number of sounds that they say?

7) What do you think the benefits of this therapy are?

8) Please feel free to add any other comments.

Thanks for filling out this form

Hannah Clements
Speech and Language Therapist

Appendix D

Accepted productions of core vocabulary target
and non-target words

Jack

| Target word | Accepted form | Non-target word | Accepted form |
|-------------|------------------|-----------------|--------------------|
| Drum | ɪɒm | Bed | bəə |
| Finish | fɪəmə | Child's name | əəə |
| Food | fʊ/fʊə.ɪɒmpi | Down | əə |
| Grumpy | ɪɒmpi/ɪɒmpə | Drink | ɹɪm |
| Keyboard | ɪbəə | Music | mʊə |
| Off | əf/ɒf | Sad | s (ingressive) ə |
| Sing | s (ingressive) ə | School | s (ingressive) k ə |
| Stand | s (ingressive) ə | Shoes | ʊ |
| Toilet | ɔɪə | Sick | s (ingressive) ə |
| Toy | ɔɪ | Wash | wə |

Sam

| Target word | Accepted form | Non-target word | Accepted form |
|-------------|--------------------------|-----------------|----------------|
| Book | gə | Car | gə |
| Drink | gə | Computer | gəgəgə/əgəgəg |
| Finish | gəgə/əgəg | Cracker | gəgə/əgəg |
| Hello | gəgə/əgəg | Dad | gə |
| Help | gə | Dog | gə |
| Michaela | gəgəgə/məgəgə/ əgəgəg | Goodbye | gəgə/əgəg |
| Puzzle | gəgə/əgəg | Mum | gə/mə |
| Talara | gəgəgə/əgəgəg | Music | gəgə/əgəg/məgə |
| Toilet | gəgə/əgəg | Park | gə |
| Zac | gə | School | gə |

Rachel

| Target word | Accepted form | Non-target word | Accepted form |
|--------------------|----------------------|------------------------|----------------------|
| Bed | bə/sign | Bath | ɑ |
| Book | bə | Car | dɑ |
| Dad | dɑ | Food | Sign |
| Drink | dɪ/sign | Home | Sign |
| Guitar | tɑ | Hug | hʌ |
| Hello | hə.ɹəʊ/sign | Off | ɔ |
| Mum | m | On | ɔ |
| Shoe | ʊ | School | sɔ |
| Toilet | tɔɪ/sign | Sleep | Sign |
| Yes | i/sign | Stop | sɔ |

Appendix E

Communicative Intent Tables

Jack

| Early Intentions | | | | |
|-----------------------|--------------|-----------------------|-----------------------------|---|
| Interaction expressed | | Gesture (8-12 months) | Vocalisation (12-18 months) | Word (18-24 months) |
| Request action | Pre therapy | | | Will say "more" or "me" to request. Jack will also use his Talara to request action. |
| | Mid therapy | | | Will say "more" or "me" to request. Jack will also use his Talara to request action. |
| | Post therapy | | | Will say "more" or "me" to request. Jack will also use his Talara to request action. |
| Request Object | Pre therapy | | | Some words used to request desired objects and use of communication aid. Will use a 4 word sentence to ask for Talara. |
| | Mid therapy | | | Some words used to request desired objects and use of communication aid Will use 4 word sentence to ask for Talara |
| | Post therapy | | | More spontaneous requests without prompts to use words and use of |

| | | | | |
|-----------------------|--------------|--|--------------|---|
| | | | | communication aid. Some words now used with consistent consonants e.g. “rum” for drum. Will put words into 2 – 4 word sentences. |
| Protest | Pre therapy | Turn head | | “uh uh” as no |
| | Mid therapy | Turn head | | “uh uh” as no |
| | Post therapy | Turn head | | “uh uh” as no |
| Comment | Pre therapy | Jack uses limited comments which could be due to his lack of vision and mobility | | |
| | Mid therapy | Jack uses limited comments which could be due to his lack of vision and mobility | | |
| | Post therapy | Jack uses limited comments which could be due to his lack of vision and mobility | | |
| Later Intentions | | | | |
| Interaction expressed | | Gesture | vocalisation | Word |
| Request information | Pre therapy | Limited request for information possibly due to vision and mobility | | |
| | Mid therapy | Limited request for information possibly due to vision and mobility | | |
| | Post therapy | Limited request for information | | |

| | | | | |
|-------------|--------------|-------------------------------------|--|---|
| | | possibly due to vision and mobility | | |
| Answer | Pre therapy | | | Only when asked what he wants – will use voice and Talara |
| | Mid therapy | | | Only when asked what he wants – will use voice and Talara |
| | Post therapy | | | Only when asked what he wants – will use voice and Talara |
| Acknowledge | Pre therapy | | | Only when asked if he understands. |
| | Mid therapy | | | Only when asked if he understands |
| | Post therapy | | | Only when asked if he understands |

Sam

| Early Intentions | | | | |
|-----------------------|--------------|---|---|---|
| Interaction expressed | | Gesture (8-12 months) | Vocalisation (12-18 months) | Word (18-24 months) |
| Request action | Pre therapy | | Vocalises to get something | Will use Talara to request an activity using “I want” and then activity |
| | Mid therapy | | Will vocalise | Request a turn by saying “me ge” (my go) |
| | Post therapy | | Will vocalise | Request a turn by saying “me ge” (my go) |
| Request Object | Pre therapy | Will use fist to point to what he wants | Will vocalise | Will use Talara to request an activity using “I want” and then the activity |
| | Mid therapy | Continues to gesture towards things he wants. | Vocalising less and now attempts to use words | Will request “puzzle’ and “book” (although not observed in classroom |

| | | | | |
|---------|--------------|---|---|--|
| | | | | session. Will use Talara to request an activity using “I want” and then the activity |
| | Post therapy | Continues to gesture towards things he wants. | Vocalising less and continues to attempt to use words | Will request “puzzle” and “book” (although not observed in classroom session). Will use Talara to request an activity using “I want” and then the activity |
| Protest | Pre therapy | Will push things away when frustrated | Will vocalise | Sam uses the ‘no’ symbol that is attached to his wheelchair/tray. If the symbol is not there he is able to indicate by placing his hand where the ‘no’ symbol should be. |
| | Mid therapy | Will push things away when frustrated | Will vocalise | Sam uses the ‘no’ symbol that is attached to his wheelchair/tray. If the symbol is not there he is able to indicate by placing his hand where the ‘no’ symbol should be. |
| | Post therapy | Will push things away when frustrated | Will vocalise | Sam uses the ‘no’ symbol that is attached to his wheelchair/tray. If the symbol is not there he is able to indicate by placing his hand where the ‘no’ symbol should be. |
| Comment | Pre therapy | | Will vocalise to get attention near to object | |
| | Mid therapy | | Will vocalise to get attention near to | Attempts to imitate words. |

| | | | | |
|----------------------------------|--------------|---------|---|---|
| | | | object | |
| | Post therapy | | Will vocalise to get attention near to object | Attempts to imitate words. |
| Later Intentions (18 -24 months) | | | | |
| Interaction expressed | | Gesture | Vocalisation | Word |
| Request information | Pre therapy | | Will vocalise to get attention. | |
| | Mid therapy | | Will vocalise to get attention | |
| | Post therapy | | Will vocalise to get attention | |
| Answer | Pre therapy | | | Uses symbols to answer yes/no. |
| | Mid therapy | | | Uses symbols to answer yes/no. Will attempt to use words when asked what specific things are. |
| | Post therapy | | | Uses symbols to answer yes/no. Will attempt to use words when asked what specific things are. |
| Acknowledge | Pre therapy | | | Only if asked if he understands. |
| | Mid therapy | | | Only if asked if he understands. |
| | Post therapy | | | Only if asked if he understands. |

Rachel

| Early Intentions | | | | |
|-----------------------|--------------|---|---|--|
| Interaction expressed | | Gesture (8-12 months) | Vocalisation (12-18 months) | Word (18-24 months) |
| Request action | Pre therapy | Signs for more | | Verbalises more [oi] |
| | Mid therapy | Signs for more Signs for songs | | Verbalises more [oi] Request songs [op] for open shut them |
| | Post therapy | Signs for more Signs for songs | | Verbalises more [oi] Request songs [op] for open shut them |
| Request Object | Pre therapy | Will stand next to item and reach | Vocalise to attract attention to object | |
| | Mid therapy | Will stand next to item and reach | Vocalise to attract attention to object | |
| | Post therapy | Will stand next to item and reach. Will consistently sign for toilet | Vocalise to attract attention to object | Will request some items e.g. [ta] for guitar. |
| Protest | Pre therapy | Will push away | Vocalises in frustration | |
| | Mid therapy | Will push away | Vocalises in frustration | |
| | Post therapy | Will push away | Vocalises in frustration | Observer to say [no] 4 times in one therapy session |
| Comment | Pre therapy | Rachel will point to something | Vocalise to attract attention to object | |
| | Mid therapy | Rachel will point to something | Vocalise to attract attention to object | |
| | Post therapy | Rachel will point to something | Vocalise to attract attention to object | |
| Later Intentions | | | | |
| Interaction expressed | | gesture | vocalisation | Word |
| Request information | Pre therapy | Gestures towards things | | |
| | Mid therapy | Gestures towards | | |

| | | | | |
|-------------|--------------|---|---------------------------------|---|
| | | things | | |
| | Post therapy | Gestures towards things | | |
| Answer | Pre therapy | Only when asked what does she want will gesture towards things. | Vocalises to provide a response | |
| | Mid therapy | Only when asked what does she want will gesture towards things. | Vocalises to provide a response | |
| | Post therapy | Only when asked what does she want will gesture towards things. | Vocalises to provide a response | Will now request for guitar and toilet (sign) only after being asked what she wants |
| Acknowledge | Pre therapy | | | |
| | Mid therapy | | | |
| | Post therapy | | | Will say hello when said hello to, but inconsistent. |