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Phonological Processes in Tamil Speaking Children with Cerebral Palsy

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Abstract

The present study aimed at identifying phonological processes in Tamil speaking children with Cerebral Palsy. Twenty Cerebral palsied Tamil speaking children, age ranged from 3.5 years to 16 years (13-Males, 7- Females) participated in the present study. All the children were screened by the extended Receptive and Expressive Emergent Language Scale to see the language age. These children were divided into 4 groups with 5 children in each group divided in one year interval. Totally 160 meaningful di-syllabic and tri-syllabic words in combination of 18 consonants, 10 vowels and two dipthongs in initial, medial and final positions were used to assess. Results revealed that thirty nine phonological processes were observed in cerebral palsied children. The present study identified that the substitution processes was the highest occurrence than other processes. Although the processes and occurrence of the process was found to decreased with increase in language age group.

Keywords: Phonological processes, Cerebral Palsy, Consonants, Vowels.

Introduction

Speech has been one of the most common modes of communication in humans. It is the verbal mode of transmitting messages involving the precise co-ordination of oral muscular movements in order to produce sounds and linguistic units. Speech consists of speech sound combinations, voice quality, intonation, and rate. Each of these components is used to modify the speech message. Language encompasses complex rules that govern sounds, words, sentences, meaning and use. These rules underlie an individual's ability to understand language and formulate language. Language occurs both receptively and expressively through reading, listening, writing, and speaking. In order to become fully functioning members of school and society, children must learn the elements, the rules, the structure and the conventions of this system. Language is generally considered to consist of five sets of rules: pragmatics, semantics, syntax, morphology and phonology (Nancy, Parley & Wayne, 1989).

Phonological disorder is one kind of parts of whole communication disorder (Bleile, 2004). Speech Language therapists assess and treat children with communication disorders (Shipley & McAfee, 2004). Phonologically, the child's words are simple containing one or two syllables. Early word development is related to both the phonological character of the words acquired and the child's emerging phonological system. Within a short period, the preschool child learns most of the conversations of language form. There are some conditions that influence the phonological development; these are Hearing Loss, Mental Retardation, Cerebral Palsy, Autism, and Learning Disability. There are a number of conditions that affect the neurological development during infancy. The damage to specific areas of the brain, either during fetal development or during or shortly after birth can lead to condition of Mental Retardation or Cerebral Palsy. Cerebral palsy is characterized by an inability to fully control motor function, particularly muscle control and coordination. Depending on which areas of the brain have been damaged, one or more of the following symptoms may manifest in this population: muscle tightness or spasticity, involuntary movement, disturbances in gait, difficulty in swallowing and speech disturbances. Other issues may consist of abnormal sensation and perception, impairment of sight or hearing, seizures, intellectual disturbances and learning disorders.

Cerebral palsy (CP) is an umbrella term referring to a class of disorders characterized by non-progressive impairments in movement and posture that are acquired early in life due to a brain abnormality (Bax 1964; Mutch et al. 1992). Many children with cerebral palsy experience communication difficulties because their motor impairments affect the range, speed, strength and consistency of movements needed to produce speech, gestures and facial expression. In addition to their motor impairments, children with CP also often experience language disorders, epilepsy, cognitive and

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sensory impairments (Aicardi and Bax 1992), which also impact on communication and its development. Problems in communication, especially poor speech production, may be a direct result of the motor impairment due to a disturbed neuromuscular control of speech mechanism (Crary 1995; Pennington & McConachie 2001a, b; Pirila et al. 2004). Further it has been documented that the severity of speech and language problems are related to the type and severity of cerebral palsy. Many children with cerebral palsy are hindered in their development of narrative skills and functional communication (Basil 1992; Light et al. 1985a, b; Pennington & McConachie 1999; Pennington, Goldbart, & Marshall 2004).

Some of the predominant features in the speech of children with cerebral palsy include poor intelligibility, articulatory variations, voice problems, prosody variations and resonance problems. They may also have difficulties with other aspects of language relating to use and choice of words, construction of sentences and production of a series of sentences, etc. Many cerebral palsied children have impaired speech in one form or another. Scholars have estimated that over 70 percent of CP children do have some problem with speech production. The speech of cerebral palsied children has been studied from different perspectives such as perceptual analysis, acoustic analysis, phonological analysis, articulatory analysis, language analysis and so on. The ability to acquire speech sounds in cerebral palsied children is limited. Although children with cerebral palsy who have no associated problems manage to develop receptive language, the acquisition of speech sounds has been a major challenge in these children. The ability to produce speech sounds is related to the neuromuscular activity. Hence, it would be interesting to understand the pattern of phonological errors, in the cerebral palsied children.

Traditional classification of CP mainly based on the distribution of involvement of the limbs of the body. The most common terms used are hemiplegia, diplegia and quadriplegia, however terms such as monoplegia and triplegia are also used (Delgado and Albright, 2003). Classification of CP by movement disorder includes spastic CP (85% of Cp population), dyskinetic (7%), ataxic (5%), hypo tonic (0.5%) and mixed (2.5%) (Stanley et al., 2000). Spastic CP is the most common type of movement disorder and is characterized by abnormal voluntary control, resistance to passive stretch and exaggerated reflexes (Stanley et al., 2000). Spastic diplegia describes a child with gross motor problems, particularly marked in the lower limbs, with usually partially retained fine motor function in the upper limbs (Stanley et al., 2000; Bax et al., 2007). Spastic quadriplegia refers to the involvement of all four limbs and the trunk (Gorter et al., 2004) with severe motor involvement with virtually no hand movements and many have very little speech and language (Bax et al., 2007). Hemiplegia typically has problems restricted to one side of the body (Bax et al., 2007) with involvement of both the upper and lower limb (Stanley et al., 2000).

Children with spastic diplegia and mild to moderate spastic quadriplegia may develop speech production relatively early in their development. Their articulation skills are generally good, but they tend to demonstrate dysphonia secondary to disorders of speech breathing. The severity and system involvement of the dysarthria in an individual has been dependent upon the degree and extent of the underlying lesion. The regression of speech production has been also observed in individuals with spasticity (Gardner, 2004). It has been established that even the normal children during period of their development present with errors that reflect the simplifications during the gradual processes of acquiring adult speech sound system. These simplifications are very common and are predictable part of the phonological development. As children begin to organize their speech sounds to match those of an adult, these phonological processes are gradually eliminated. Phonological processes are found in normal as well as Cerebral palsy, Down's syndrome, Mental Retardation, Autism, Attention Deficit Hyperactive Disorders, Learning Disability, Hearing Impairment, Apraxia, and Stuttering.

Phonological processes are systematic sound changes that affect a class of sounds or a sound sequence (Edwards and Shriberg, 1983). Hodson and Paden (1983, p. 102) defined phonological processes as a "regularly occurring deviation from standard adult speech patterns; may occur across a class of sounds, a syllable shape, or syllable sequence". In short, processes are descriptions of regularly occurring patterns observed in child's speech which operate to simplify adult targets. Phonological processes are the patterns that young children use to simplify adult speech. All children use these processes while their speech and language are developing and as they mature, they stop using these patterns to simplify words (Ranjan, 2009).

Although more than 40 different processes have been identified as occurring in child phonology, only a handful occur with any frequency. Those processes that commonly occur developmentally in normal children across languages are called natural processes. Processes that never occur, or occur only rarely, in normal child phonology are called unusual or idiosyncratic processes (Stoel-Gammon and Dunn, 1985). Examples would include deletions of initial or final consonants, additions of sounds (epenthesis) or rearrangements of sounds (metathesis). Phonological processes are classified into ten types. They are context sensitive voicing, word final devoicing, final consonant deletion, velar fronting, palatal fronting, consonant harmony, weak syllable deletion, cluster reduction, gliding of liquids and stopping (Bowen, 1999). Different phonological processes disappear at different age. According to Bowen (1999) some phonological processes (Gliding, Stopping, Cluster Reduction, and Weak Syllable Deletion) disappear within 4-5 years of age. According to Shipley & McAfee (2004) seven phonological processes (cluster

reduction, epenthesis, gliding of liquids, vocalization, stopping, depalatalization and word final devoicing) exist after age three.

The particular concern of speech and language pathologist in articulation disorders has been phonology. When treating these children, consideration must be given to the developmental acquisition of sounds. However, the general rule should be to choose a sound that the child is able to imitate and which will make the greatest differences to child's speech intelligibility. Knowledge about phonology has been increased rapidly in recent years, particularly in the area of child phonology (Hodson & Paden, 1983). A majority of early research on child phonology was based on a linguistic approach as distinct from psycholinguistic and production oriented. The purpose of this study was to identify the patterns of phonological process in children with cerebral palsy. This information would extend Speech Language therapist to understand phonology of children with cerebral palsy by adding to body of knowledge regarding the appearance, productive duration and disappearance of phonological processes. Further this will direct speech Language therapist to plan an appropriate intervention method in treating children with phonological disorders.

Aim of the study

The aim of the present study is to identify the patterns of phonological processes in children with cerebral palsy.

Method

Participants

cerebral palsied Tamil speaking children in the age range of 3.5 years to 16 years (13-Males, 7-Females) were included in the study as shown in Table 1. Participants were recruited from three different special schools in Tamilnadu(Chennai, Trichy and Salem). All the children were screened by the extended Receptive and Expressive Emergent Language Scale (REELS; Bzoch and League, 1979). Participants were included having language age of 2.5-6.5 years, spastic CP with mild to moderate mental subnormality (Psychologist report) and epilepsy (only in 3 children who recovered after medications reported by parent) in the current study. On the other hand participants were excluded who are having hearing loss, visually impaired and autism.

Table I. Distribution of subjects across Language age groups (Years-Months)

Age group	Language age range	Male	Female	Total No. of Subjects
1.	2.5 - 3.5	3	2	5
2.	3.5 – 4.5	3	2	5
3.	4.5 – 5.5	2	3	5
4.	5.5- 6.5	5	0	5

Tool

Phase 1: 5000 words in combination of 18 consonants, 10 vowels and two dipthongs in initial, medial and final positions were developed.

Phase 2: These 5000 words are validated with five BASLP intern students and five speech language therapists to see familiarity, meaningful 500 words.

Phase 3: These 500 words validated with investigator and guide and came to 380 words further these words are reduced to 160 words meaningful, easy, familiarity and so that children can produce easy with short duration.

Phase 4: These 160 words are administered in 3 typically developing children Tamil speaking childern to see the duration of test.

Phase 5: Final test tool was finalized after using in 3 typically developing children.

Totally 160 meaningful di-syllabic and tri-syllabic words in combination of 18 consonants, 10 vowels and two dipthongs in initial, medial and final positions were used to assess. These words are specifically developed among 5000 words. All these words are selected from the basic Tamil picture book to categorize phonological processes in children. All these words are easy, simple familiar and meaningful.

Procedure

An informed oral consent was obtained from parents/caregivers of all children prior to data collection. The children were seated comfortably and tested individually by the investigator in a room with minimum distraction. The children are instructed to repeat words one at a time with an interval of 5 seconds after the investigator and productions of the speech were recorded using Transcend MP 330.

Analysis

An informal procedure for maximizing phonological process information from traditional picture- word articulation test analysis as described by Vasanta (1990) was employed for analysis of phonological processes. In Tamil, the consonants and vowels occur in all three positions in the words (initial, medial and final). Model and replica charts were constructed as three different tables for initial, medial and final positions for consonants and vowels. The frequency of occurrence of each phoneme in a given position in the words was listed for the entire test. Following the construction of the model and replica chart, the error responses were also listed on the model

and replica chart. The data from the model and replica chart was used to analyze each consonant and vowel of each stimulus word to identify phonological processes. The definition of phonological processes given by Ingram (1981) was followed for classification of the phonological processes present in the sample. In cases where the errors could not be classified using the list of processes given by Ingram (1981), the errors were described using the definition of phonological processes given by Grunwell (1987). The phonological processes were tabulated and total number of occurrence of each process was noted. The percentage of occurrence of processes were computed by dividing the number of occurrence each process by the total number of opportunity for the process to occur as derived from the model and replica chart for initial, medial and final positions. The percentage of occurrence was computed only for those processes where it was possible to discern the number of opportunity for the process to occur.

Results and discussion

The aim of the present study is to identify patterns of phonological processes in children with cerebral palsy. Totally 39 phonological processes were identified in children with cerebral palsy. In the present study, data obtained from speech sample was analyzed to enumerate the common phonological processes in children with Cerebral Palsy. Qualitative analysis was done to report the findings. The results have been discussed with respect to common phonological processes. The investigation revealed 39 phonological processes which occur most commonly in children with Cerebral Palsy.

Table II. Classification of phonological processes identified among Cerebral Palsied Tamil speaking children

Syllable structure	Substitution	Assimilation	Vowel
ICD	Bilabial backing	Dental assimilation	Vowel fronting
MCD	Dental fronting	Palatal assimilation	Vowel backing
FCD	Dental backing	Retroflex assimilation	Vowel raising
ISD	Alveolar fronting	Nasal assimilation	Vowel lowering
MSD	Palatal fronting	Nasalization	Vowel lengthening
FSD	Palatal backing	Denasalization	Vowel shortening
	Velar fronting	Reduplication	Dipthongation
	Retroflex fronting	Post vocalic voicing	Monophthongation
	Retroflex backing		IVD
	Liquid gliding		MVD
	Liquid stopping		Final dipthong deletion
	Stop gliding		
	Glide stopping		
	Glide liquiding		

Syllable Structure Processes

The percentage of occurrence of SSP was not calculated by percentage because of the large number of possible opportunities. The syllable structure processes including ICD, MCD, FCD, ISD, MSD and FSD were demonstrated by all language age groups (Table-2).. However, the processes occurred in less number of instances in the higher language age groups (4.5- 5.5 yrs and 5.5- 6.5 yrs) than lower language age group (2.5-3.5 yrs and 3.5 – 4.5 yrs). The maximum number of instances of occurrence across processes ranged from one to twenty nine for younger language age group (2.5 to 3.5yrs). ISD was not observed after 3.5 yrs of language age group. SSP was demonstrated maximum number of instances of occurrence across processes ranged from one to ten in 3.5 to 4.5 years of language age group. On the other hand ISD, MSD and FSD were not demonstrated by other two language age groups. However, maximum number of instances of occurrence across processes ranged from one to four in other two groups. Final consonant deletion and Medial syllable deletion was observed in almost all children in the younger age group of 2.5 to 3.5 years. These findings are concurrence with study done by Bharathy, 2001 that the younger children 3- 4 years have more number of instances of occurrence than older language age group. The results indicates that the decrease in phonological processes with increase in age. Bernthal and Bankson(1990) have reported that children of 3-4 years exhibit FCD as a common process. This process has been reported to be eliminated by the age of 3.3 years in normally developing children (Bowen, 1999). Bharathy (2001) have reported that Tamil speaking children demonstrated FCD as a common process and it faded after the age of 3.5 years. However, the process of FCD was found to be persisting in children with CP even after 4 years. The presence of final consonant deletion in children with CP could be because of inadequate tongue functioning and poor respiratory control. As a result of these deficits, the children could not produce the whole word. Syllable reductions in initial, medial and final

positions were demonstrated in children in the language age of 2.5 to 3.5 years and gradually it was reduced in higher language age group between 4.5 years to 6.5 years.

Table III. Number of children demonstrating syllable structure processes in the four language age groups

Syllable structure	2.5 - 3.5 Years N=5	3.5 - 4.5 Years N=5	4.5 – 5.5 Years N=5	5.5 – 6.5 Years N=5
ICD	4(2-5)	1(1)	1(2)	1(2)
MCD	4(1-12)	3(1-6)	2(1-2)	3(1-2)
FCD	5(2-29)	5(4-10)	3(1-2)	3(3-4)
ISD	4(1-5)	---	---	1(1)
MSD	5(2-26)	3(3-7)	----	---
FSD	4(3-7)	3(1-6)	1(1)	---

Note: The number in parenthesis represents the range of the number of times a process occurred among the cerebral palsied children. ICD(Initial consonant deletion), MCD(Medial consonant deletion), FCD(Final consonant deletion), ISD(Initial syllable deletion), MSD(Medial consonant deletion), FSD(Final consonant deletion)

Substitution processes

The substitution processes demonstrated by children with CP included Fronting (Dental, Alveolar, Palatal, Retroflex and Velar), Backing (Bilabial, dental, Alveolar, Palatal and Retroflex), Gliding (Liquid and Stop), Stopping (Liquid and Glide) and Glide liquiding. Among these, the process of fronting and backing occurred in all three positions. Gliding and stopping was seen in medial and final position. Glide liquiding was infrequently observed in children with cerebral palsy. However, the maximum number of instances of occurrence across processes ranged from one to twelve in the age group of 2.5 years to 3.5 years, one to nine in the age group of 3.5 to 4.5 years, one to eight in the age group of 4.5 to 5.5 years and one to two in the age group of 5.5 to 6.5 years. The number of instances of occurrence across processes reduced as the age increases. Fronting of alveolar, retroflex and velars were most predominant amongst the other type of processes and remains consistent with respect to number of occurrences in 2.5 years to 5.5 years of age. On the other hand a less number of occurrences were observed after the age of 5.5 years. Roberts et al., (1990) reported that fronting was a common process between 2.6 years to 4 years of age investigations in Indian languages has revealed fronting to be a decreasing process. These include Malayalam (Sameer, 1998), Hindi (Ranjan, 2001) and Tamil (Bharathy, 2001).

Backing was observed in first three language age groups. However more number of children demonstrated in the age group of 2.5- 4.5 years and gradually decreased in the age group of 4.5-6.5 years. Backing was observed in bilabials, dentals, alveolar and palatals. In consonance with Bharathys (2001) investigation in 3-4 years old Tamil speaking children, backing was found to be a decreasing process. However, Stopping was observed in the age group of 2.5 to 3.5, 3.5 to 4.5 years and 4.5 to 5.5 years and seen in liquids and glide sounds. Liquid stopping was observed in 15 children and occurrence of the process was ranged from 1-8. On the other hand glide stopping was demonstrated in 2.5 years to 3.5 years and occurrences ranged from 1-2. Liquid stopping was observed till 5.5 years of age and glide stopping was not observed after the age of 3.5 years. This is in consonance with the findings of Haelsig and Madison (1986) in English, and Bharathy 2001. In English speaking children, Roberts et al., (1990) found stopping to be most common between 2.6 and 4 years. This study found the same although the process was seen to persist till 5.5 years. More over gliding was demonstrated in all age groups in liquids and stops. The frequency of occurrence was ranged from 1-12. Stop gliding was not observed in the age group of 4.5 years. It was found to persist till the age of 5 years and is therefore termed a persisting process. This was also reported by Grunwell (1982, Khan and Lewis (1986), and Bernthal and Bankson (1990).

Table IV. Number of children demonstrating substitution processes in the four language age groups

Substitution		2.5 -3.5 years			3.5 -4.5 years			4.5 – 5.5 years			5.5 – 6.5 years		
	Positions	Initial	Medial	Final	Initial	Medial	Final	Initial	Medial	Final	Initial	Medial	Final
Fronting	Dental	1(2) [16.6%]	1(1)	---	---	---	---	---	---	---	---	---	---
	Alveolar	---	3(1)	2(1)	1(1)	1(1)	---	---	3(1)	1(1)	---	2(1)	---
	Palatal	2(1-9) [7-64%]	4(1-8) [8-61%]	4(1-10) [11-	2(4-9)	3(1-4)	4(1-3)	---	3(1-8)	2(1-2)	---	1(3)	---

				100%]									
	Retroflex	---	5(1-5) [9-40%]	4(1-6)	---	1(8)	3(1-7)	---	2(4-6)	2(1-2)	---	---	---
	Velar	3(1-7) [8-58%]	3(2-6) [5-30%]	2(2-3)	1(1)	3(1-4)	---	---	2(1-3)	1(1)	---	---	---
Backing	Bilabial	2(1) [10%]	3(1-3)	1(1)	1(1)	---	---	1(1)	---	---	1(1)	1(1)	---
	Dental	1(3) [25%]	2(1)	1(2)	2(1-2)	3(2-4)	1(1)	---	4(2-3)	3(2)	---	2(1)	1(2)
	Alveolar	---	3(1)	2(1)	---	1(1)	---	---	1(1)	---	---	---	---
	Palatal	---	2(1)	1(1)	---	---	2(1)	---	---	---	---	---	---
	Retroflex	---	---	1(1)	---	---	---	---	---	---	---	2(1)	---
Gliding	Liquid	---	3(4-10) [44-80%]	3(4-11) [10-100%]	---	3(1-6)	2(1-2)	---	---	---	---	---	---
	Stop	---	3(1-4)	1(10)	---	2(1)	---	---	1(1)	---	---	---	---
Stopping	Liquid	---	5(2-4)	5(1-3) [20-60%]	---	2(1)	4(1-4)	---	4(1-8)	1(1)	---	---	---
	Glide	---	1(1)	2(1-2)	---	---	---	1(1)	---	---	---	---	---
Glide Liquiding		---	---	1(1)	---	1(1)	---	---	---	---	---	1(1)	---

Note: The number in parenthesis represents the range of the number of times a process occurred among the cerebral palsied children and /or the range of the percentage of occurrence of the process among the children who demonstrated the process.

Assimilation process

Assimilation processes like Nasalization, Denasalization, Dental assimilation, Palatal assimilation, Retroflex assimilation and Nasal assimilation were observed in the age group of 2.5 years to 5.5 years. However, more number of children demonstrated in younger age group then 2.5 years to 3.5 years and not seen after 3.5 years except retroflex assimilation. Denasalization and nasalization was more frequently occurred in younger age group than other age groups. Although the frequency of occurrence of this process decreased with age, it was found to persist till the age of 5 years. This declination and persistence is in consonance with findings in English Haelsig and Madison, 1986, Tamil Bharathy 2001. Reduplication and post vocalic voicing were observed only in one child and the frequency of occurrence was one.

Table V. Number of children demonstrating assimilation processes in the four language age groups

Assimilation		2.5 -3.5 years			3.5 -4.5 years			4.5 – 5.5 years			5.5 – 6.5 years		
	Positions	Initial	Medial	Final	Initial	Medial	Final	Initial	Medial	Final	Initial	Medial	Final
Assimilation	Dental	---	1(1)	---	1(1)	---	---	---	---	---	---	---	---
	Palatal	---	1(2)	---	---	---	---	---	---	---	---	---	---
	Retroflex	---	1(2)	---	1(1)	---	1(1)	---	1(1)	---	---	1(1)	---
	Nasal	---	2(1-7)	---	---	1(1)	1(1)	---	1(1)	---	---	---	---
Nasalization		1(3)	5(2-11)	5(1-5)	---	4(1-3)	2(1)	1(1)	3(1)	---	---	1(2)	---

Denasalization		1(2)	4(1-5)	2(3-4)	---	1(1)	---	---	1(1)	---	---	---	---
Reduplication		---	1(1)	---	---	---	---	---	---	---	---	---	---
Post vocalic voicing		---	---	---	---	---	---	---	---	1(1)	---	---	---

Note: The number in parenthesis represents the range of the number of times a process occurred among the cerebral palsied children

Vowel processes

The number of vowel processes was examined vowel fronting, vowel backing, vowel raising, vowel lowering, vowel lengthening, vowel shortening, dipthongation, monophthongation, initial vowel deletion, medial vowel deletion and final dipthong deletion. However, vowel fronting was seen in 5 children and the frequency of occurrence ranged from 2-4 among younger age group of 2.5 to 3.5 years. Vowel backing and vowel lowering was demonstrated in all language age group and frequency of occurrence from one to four. Vowel lengthening and vowel shortening was observed in only in the age group of 2.5 to 3.5 years. Monophthongation was seen in 8 children with CP in the first three language age group and instances of occurrence across age group ranges from one to five. On the other hand dipthongation was observed in first two groups and frequency of occurrence from one to ten. Minimally occurred processes are vowel raising, MVD and final dipthong deletion among children with cerebral palsy.

Table VI. Number of children demonstrating vowel processes in the four language age groups

Vowel		2.5 -3.5 years			3.5 -4.5 years			4.5 – 5.5 years			5.5 – 6.5 years		
	Positions	Initial	Medial	Final	Initial	Medial	Final	Initial	Medial	Final	Initial	Medial	Final
Vowel	Fronting	1(2)	---	4(2-4)	---	1(1)	---	---	---	---	---	---	---
	Backing	2(1-3)	3(2-4)		1(1)	2(1-2)	2(1-3)	2(1)	2(1)	---	1(1)	1(2)	---
	Lengthening	1(2)	4(1-3)	1(3)	---	---	---	1(1)	---	---	---	1(1)	---
	Shortening	5(1-2)	1(1)	1(1)	1(1)	---	---	2(1-2)	---	---	---	1(2)	---
	Raising	---	1(1)	---	---	1(1)	---	---	---	---	---	1(1)	1(1)
	Lowering	4(1-2)	3(1-3)	3(1-3)	1(1)	1(4)	1(2)	2(1-4)	1(1)	1(1)	1(2)	---	1(1)
IVD		5(1-3)	---	---	2(1)	---	---	---	---	---	1(1)	---	---
MVD		---	1(1)	---	---	---	---	---	1(1)	---	---	---	---
Monophthongation		4(1)	---	3(1-5)	---	---	5(1-3)	2(1)	---	---	---	---	---
Dipthongation		2(1-2)	---	2(6-10)	---	---	2(1)	---	---	1(1)	---	---	---
Final dipthong deletion		---	---	---	---	---	1(1)	---	---	---	---	---	---

Note: The number in parenthesis represents the range of the number of times a process occurred among the cerebral palsied children. IVD (Initial vowel deletion), MVD (Medial vowel deletion)

Overall, this study found thirty nine processes to be exhibited in the Tamil speaking children with cerebral palsy. It was noticed that the processes are decreases as the language age increases in children and frequency of occurrences across processes decreased in older age group. The declining use of phonological processes with increasing age has been reported in across languages including English (Grunwell, 1982; Hodson and Paden, 1983; Haelsig and Madison, 1986; Preisser et al., 1988; Roberts et al., 1990), Malayalam (Sameer, 1998; Anilsam, 1999), Kannada (Sunil, 1998; Jayashree, 1990.

Conclusion

The study provided preliminary evidence for differences in the development of phonological processes in Tamil speaking children with cerebral palsy. The present study identified totally thirty nine phonological processes and among these substitution processes was the highest occurrence than other processes. The

presence of highest occurrence of substitution processes in children with CP could be because of inadequate tongue functioning and poor respiratory control. Although the processes and occurrence of the process was found to decreased with increase in language age group.

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