Morphosyntactic development in very preterm children diagnosed with a Speech Sound Disorder

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INTRODUCTION

In the Netherlands about 1% to 2% of the children are born very preterm with a gestational age (GA) below 32 weeks. The proportion of very preterm (VP) children in the Netherlands increased between 1983 and 2008 from 0.63% to 1.14% due to various reasons.[1,2] For instance, the survival rate of premature children has increased significantly in recent decades as a result of developments in medicine.[3] Another reason for preterm birth can be found in the increasing age of the first pregnancy.[1]

VP children concur with higher rates of all kinds of problems compared to full term (FT) children. More specifically, it has been shown that preterm children concur with higher rates of neurological, motor or cognitive impairments and disabilities due to their immaturity.[2,4–6]

In line with these general health problems, a higher prevalence of speech and language problems has been found.[3,5,7–12] A meta-analysis by Barre et al.[10] concluded that VP children show significantly poorer language functions compared to FT children. VP children perform less than FT children on overall expressive and receptive language measures and in the more specific subdomains of expressive and receptive semantics. The performance of VP children for expressive and receptive grammar was questionable compared to FT children. Moreover, in a systematic review of language functions in preterm children, Van Noort-Van der Spek et al.[11] showed that the population of preterm children performs significantly poorer compared to FT children on language function tests, even in the absence of major disabilities and independent of social economic status. However, it is not yet known whether the nature of the speech and language problems of VP children can be compared to the problems of FT children.

In FT children a Speech Sound Disorder (SSD) typically occurs with morphosyntactic problems.[13–17] The percentage of children with SSD who also have a delay in grammatical development is estimated around 80%.[15] Grammatical deficiencies could be even the result of phonological disorders, due to dysfunction of the cognitive workload and phonological awareness.[17] For VP children it is unclear whether this relation between phonology and morphosyntactic development also exists. Van Noort-Van der Spek et al.[18] concluded that VP children at two years of corrected age had significantly fewer acquired consonants than FT children. If phonological development and morphosyntax are strongly correlated, VP children with only a few acquired consonants may also be delayed in their morphosyntactic development.

Concluding that VP children perform significantly poorer compared to FT children on language tests, VP children with a SSD might have a higher risk of developing a language delay. More knowledge of the grammatical development of VP children with a SSD and the

association between the grammatical and speech sound development in these children might help to instigate an effective intervention which may improve long-term outcomes.

Therefore, the aim of this study was to describe the morphosyntactic profile of VP children diagnosed with a SSD at the corrected age of two and to investigate whether there is a relation between morphosyntactic development and phonological development in VP children at the corrected age of two. Based on the literature reviews about language development in VP children[10,11], a delay in morphosyntactic development in VP children is expected. In concordance with studies about the comparison between linguistic profiles[13,15], it is hypothesized that VP children with only a few acquired consonants may also be delayed in their morphosyntactic development.

METHOD

Setting and participants

This observational prospective study focused on VP children born at Erasmus MC Neonatal Intensive Care Unit in Rotterdam. Data were obtained from an ongoing study 'Early intervention for SSD in very preterm or very low birth weight children'. Researchers of Erasmus MC examine in the ongoing study the efficacy of an early parent-based speech intervention program for two year old VP children diagnosed with a SSD, defined by the Number of Acquired Consonants (NAC), whereby NAC is a measure of the phonological development.

For the present study twenty VP children diagnosed with SSD were included. These children were between 2;0 – 2;6 years of corrected age. In this study the corrected age is calculated by subtracting the number of weeks born before 40 weeks of gestation from the chronological age. All participants were singleton born with a gestational age below 32 weeks and/or birth weight below 1500 grams. The participants had no cognitive difficulties as measured with the Bayley Scales of Infant Development (BSID-NL-III).[19] All participants had normal hearing levels and Dutch as their first language. Receptive language Quotient Score was measured with Reynell Test voor Taalbegrip[20] or Schlichting Taaltest voor Taalbegrip[21]. As this study focused on the relation between phonological and morphosyntactic development, all selected children had a maximum of seven acquired consonants as measured with a Dutch standard system for assessment of phonological development (FAN; Fonologische Analyse Nederlands).[22–24] Participant characteristics are shown in Table 1.

Parents of the participants have been informed and asked for consent by the researchers of the intervention study in Erasmus MC. The study was conducted according to the principles of the Declaration of Helsinki, last modified version 64th WMA General

Assembly, Fortaleza, Brazil, in October 2013 and in accordance with the Dutch Medical Research Involving Human Subjects Act (WMO).[25,26]

INSERT TABLE 1 ABOUT HERE

Procedure

Data collection and processing. During a child-parent interaction setting with age-appropriate toys (farm and animals), twenty minutes of the child's spontaneous speech was video recorded at the Erasmus MC. All utterances of the child and parent were transcribed by the first researcher using the Codes for the Human Analysis of Transcript (CHAT) and analysed with the Computerized Language Analysis (CLAN) program available through the Child Language Data Exchange System (CHILDES).[27] Transcription and coding decisions were made based on the criteria described in the CHILDES manual. [28]

Outcome measures.

Morphosyntactic development. Morphosyntactic development was assessed by analysis of the recorded spontaneous speech of the child-parent interaction, using the 'Grammaticale Analyse van Taalontwikkelingsstoornissen' (GRAMAT), the Dutch version of LARSP.[29] Decisions concerning segmentation and analysis of the utterances, were based on the criteria described in the GRAMAT manual. GRAMAT provides normative data of the most frequently used morphosyntactic structures of Typically Developing (TD) children between the ages of one and four years old, divided into six age-groups of six months (Table 2).[30]

INSERT TABLE 2 ABOUT HERE

In this study the morphosyntactic structures of VP children at 2;0 – 2;6 years of age, corrected for gestational age, were charted. A reliable GRAMAT-analysis requires fifty to hundred utterances at clause level[31], so for each transcript the first hundred utterances that can be analysed were selected. Utterances that were unintelligible, fixed expressions (minors) and repetitions were excluded because they are not relevant for morphosyntactic analysis. Imitations of parental utterances were included. The utterances were classified at clause (complex sentences) level, phrase (clause elements) level and word-morphology (word structure) level.[29] In order to compare the morphosyntactic development of VP children with TD full term children, the frequencies of GRAMAT's morphosyntactic structures were counted and converted into interquartile values in accordance with the GRAMAT manual. Subsequently, the occurrence of certain structures in the spontaneous speech of VP children was measured and categorized as insufficient (< 25th percentile), sufficient (25th - 75th

percentile) or above average (> 75th percentile) compared to FT children. Values below the 25th percentile and above the 75th percentile (i.e. the second and the third quartile) are considered as below or above average.[29,30] For each participant the number of acquired structures was measured. Data transformation occurred for language samples with fifty to hundred analysable utterances. Data were transformed to be comparable to samples with hundred utterances, by dividing the frequency of the structures by the number of utterances multiplied by hundred. Participants who did not reach the minimally required fifty utterances were not included for statistical analyses.

MLU and MLU5. Mean Length of Utterance (MLU) and Mean Length of the five longest utterances (MLU5) are part of the GRAMAT and were calculated for each child as an estimate of the morphosyntactic complexity and a valid marker of language impairment.[32,33] MLU was calculated by dividing the total number of morphemes by the number of utterances.[32,34] The MLU5 is the MLU of the five longest utterances in a sample.[30] MLU and MLU5 were calculated for the spontaneous speech samples and based on analyses at the %mor-tier and measured by CLAN.[27] The commands in CLAN are included in Appendix 1. The MLU and MLU5 values of the VP children were compared to the normative data of the MLU and MLU5 values for TD children in the GRAMAT manual. The normative data of the MLU and MLU5 of the GRAMAT for TD children are shown in interquartile ranges in Table 3.

INSERT TABLE 3 ABOUT HERE

NAC. Number of Acquired Consonants (NAC) is measured with a Dutch standard system for the assessment of phonological development in young children (FAN; Fonologische Analyse Nederlands). A consonant is acquired if the consonant was attempted at least three times with a percentage of correct production of at least 75%.[22–24] For Dutch-speaking children at 2;2 years of age, nine initial consonants are typically acquired.[23] A score of less than seven consonants is defined as clinically relevant.[18]

Reliability. To verify the reliability of transcription and analyses, the inter- and intrarater reliability was measured. Interrater reliability (IRR) was determined for the number of analysed utterances in a transcript for five randomly selected recordings by comparing the results of two independent raters. The IRR for GRAMAT-analyses was determined by comparing the results of the first researcher with the results of an independent rater for five randomly selected transcripts. Intrarater reliability was determined for the GRAMAT-analyses. Five randomly selected recordings were analysed in the same manner as the first analyses. To control for carryover effects, the second analyses were done at least four weeks after the initial analyses. The inter- and intrarater reliability were calculated using

Cohen's Kappa (κ) and intraclass correlation coefficients (ICC) with statistics single measures, type consistency and two-way random model.[35,36] The criteria for the statistics κ and ICC was set at < .4 = poor agreement, .4 -.6 = moderate, .6 - .8 = good, and > .8 = very good agreement.[35] Table 4 summarizes the results of the inter- and intrarater reliability.

INSERT TABLE 4 ABOUT HERE

A good agreement was determined for the interrater reliability for analysed utterances (.713). The interrater reliability for the GRAMAT-analyses had a poor or moderate agreement for analysis two (.392) and four (.439). Consensus between two raters was reached by discussion. After the consensus discussion, all other analyses were reanalysed using the knowledge gained through the discussion. The intrarater reliability was moderate for analyses two (.531) and three (.437). The moderate intrarater reliability was mainly caused by differences in interpretation of the criteria for the label repeated utterances.

Statistical analyses. Descriptive outcomes (mean, standard deviation, range) were computed using Statistical Package for the Social Sciences 20 (SPSS 20).[37] To compute the association between NAC and MLU, NAC and MLU5 and between NAC and the number of acquired structures, Spearman correlation coefficient was used. The level of significance was set at p = <.05 (two-tailed). The strength of association between the variables was rated as follows: little or no relationship < .25, fair relationship .25 - .50, moderate to good relationship .50 - .75 and good to excellent relationship > .75.[35]

RESULTS

Descriptive outcome data

Fifteen participants reached the required minimum amount of fifty analysed utterances per language sample. Five out of the twenty participants did not reach the required minimum amount. Insufficiency was mainly due to unintelligibility utterances and the large number of minors. Table 5 presents the amount of total utterances and the types and amount of the utterances that were excluded. The five participants who did not reach the minimally required fifty utterances are marked with an asterisk.

INSERT TABLE 5 ABOUT HERE

Morphosyntactic development

MLU and MLU5. Table 6 presents the measures on the MLU and MLUL5. Compared to TD children, the MLU scores of the VP children were within the lowest 25th percentile. Compared to TD children, the MLU5 scores of the VP children were within the lowest 25th percentile with exception of two participants (11 and 12) whose MLU5 scores were below 50th percentile.

INSERT TABLE 6 ABOUT HERE

Acquired GRAMAT structures. Five VP children produced insufficient utterances. In general, these five VP children used morphosyntactic structures of GRAMAT stage I, which covers the period from 1;0 – 1;6 years (Table 2), the stage of one-element utterances. A few structures of stage II (1;6 – 2;0) and III (2;0 – 2;6) were produced.

Five out of twenty VP children produced the hundred necessary utterances and data transformation was used in ten children who had between fifty and hundred utterances. Fifteen children produced an above average (> 75th percentile) number of one-word utterances (GRAMAT stage I). For two-word utterances (GRAMAT stage II) no specific structures were found that all VP children produced at a below or above average number (< 25th or > 75th percentile). For GRAMAT stage III (three-/ four-word utterances), eight out of twenty-one structures were produced at an average or above number (> 25th percentile) by all children. These structures are: AA, SAA, SC, SVAO, SVC, VSX, VX and prepN. Abbreviations and explanations of the acquired structures of the GRAMAT profile chart are included in Appendix 2. The structures OAV and SVO do not occur in any of the spontaneous language samples. For GRAMAT stage IV (four- and more than four-word-utterances) ten children used one or more structures. The structures 4+, appositie, detadjN, preppers and ovt were not produced in the spontaneous language samples. Two VP children used two structures of GRAMAT stage V, respectively indef and QXYZ. The structures subord, coord, advadj did not occur in any of the spontaneous speech samples. Structures of GRAMAT stage VI were not produced. For the fifteen participants who achieved the required minimum amount of fifty utterances, the number of acquired structures per stage is presented in Table 7. GRAMAT Stage I, II and III contain a total of thirty-two possible structures. Three VP children achieved more than twenty different structures.

INSERT TABLE 7 ABOUT HERE

Correlation between phonologic and morphosyntactic development

In this study a moderate correlation was found between NAC and MLU ($r = .528$, $p < .05$) and between NAC and MLU5 ($r = .555$, $p < .05$). The correlation between NAC and the number of acquired structures was calculated for the group VP children with sufficient analysed utterances. No significant correlation was found between NAC and acquired structures ($r = .205$, $p > .05$).

DISCUSSION

The purpose of this study was to describe the morphosyntactic profile of VP children diagnosed with a SSD at the corrected age of two and to investigate whether there was a relation between morphosyntactic development and phonological development in VP children. The results of this study imply a morphosyntactic delay of at least a half year compared to TD children. It is proven that for VP children in this age-group, phonological proficiency is related to morphological complexity.

Morphosyntactic development

The morphosyntactic complexity of the VP children was compared to TD full term children. The MLU and MLU5 are comparable to the MLU(5) scores of TD children of 1;6 to 2;0 years of age.[30] Therefore, the results imply that there is an indication of a delay in morphosyntactic complexity based on the MLU(5) scores.

According to the GRAMAT-analyses, the morphosyntactic development of the VP children shows a delay compared to FT children. This is shown by the fact that fifteen children produced a number of one-word utterances (GRAMAT stage I) above 75th percentile. Typically, the number of one-word utterances decreases as children grow older.[29] For GRAMAT stage III, eight out of twenty-one possible structures were sufficiently produced. Given the corrected age of the VP children, they should have acquired more structures of stage III. Surprisingly, a few children produced some structures of stage IV and V. For these structures they produced above average (> 75th percentile). For these children, there appears to be no clear link between the acquired structures and the number of acquired consonants since some of these children acquired only one or two consonants.

As shown in Table 5, 25% of the VP children had insufficient analysed utterances and were not included because of failure to meet criteria for reliable GRAMAT-analysis. Remarkably, four out of these five children had acquired no more than one consonant. One child has acquired no consonants at all. Although the language samples were too small in size, for these children, there appears to be a clear link between a low number of analysed utterances and the few acquired consonants

Relation between morphosyntactic development and phonological development

In this study a moderate relationship was found between NAC and the MLU(5) scores. The more consonants acquired, the better development of the expressive grammar. This tendency is consistent with previous studies indicating that the phonologic and morphosyntactic abilities are related.[15–17,38] No significant correlation was found between NAC and the number of acquired structures. Apparently, in this study MLU is a better indicator of grammatical proficiency than the number of acquired structures, although both measurements showed a delay in the expressive language development. Due to sample size, statistical outcomes must be interpreted with care.

The systematic review of Van Noort-Van der Spek et al.[11] showed that VP children perform significantly poorer compared to FT children on language function tests. The results of this study were consistent with those findings. Compared to the normative data in the GRAMAT manual, the morphosyntactic development of VP children shows many inadequacies and a delay of at least half a year compared to FT children. The VP children have average scores on the BSID-NL-III and Schlichting Test voor Taalbegrip or Reynell Test voor Taalbegrip (Table 1). Therefore, this morphosyntactic delay cannot be explained by IQ or language comprehension difficulties. It is beyond the aim of the study, however, it would be interesting to compare the results of MLU(5) and NAC to other linguistic variables.

Strength and limitations

A limitation of this study is the small sample size, due to heterogeneity of the participants. Another limitation is the data transformation, which was used in ten of the twenty GRAMAT-analyses. Data transformation could have a negative impact on the reliability. A clear strength of this study is the spontaneous language analysis. Spontaneous language analysis examines many morphosyntactic structures and is appropriate to expose the weaknesses in morphosyntactic development.[34,39,40] However, when parents interact with their children, this may result in closed questions and complete sentences, which can have a negative effect on the reliability of the sample as a reflection of the language development of the child.[39] In this study, parents interact with their children, whereby the reliability of the language samples could be reduced. Furthermore, strengths of this study were the use of a semi-structured situation by using the same set of toys and duration of the sample and the procedure of the inter- and intrarater reliability. The inter- and intrarater reliability was calculated on the main aspects of the GRAMAT-analyses. These measurements had a positive effect on the reliability of the analyses, thereby increasing the reliability of the results. The study become more valuable compared to other studies without a reliability procedure.

Clinical implications

VP children diagnosed with SSD also have a delay in morphosyntactic development. Previous studies concluded that phonological and morphosyntactic abilities were related in FT children. This findings are consistent with phonologic and morphosyntactic abilities of VP children. When a child is diagnosed with speech and language problems, the speech language therapist must determine which intervention is most effective.[15] Tyler et al.[41] concluded that alternating phonological and morphosyntactic goals may be preferable when children have co-occurring deficits in these domains. Moreover, intensive language interventions and parent-implemented language interventions are effective approaches for young children.[42] VP children are proven to be at risk, hence early intervention is recommended.

Conclusion and recommendations

This study have ensured a homogeneous group of VP children, whereby more inside information about morphosyntactic development was obtained for this particular age-group. Overall, the results of this study imply a morphosyntactic delay in VP children with a SSD for this particular age of 2;0 – 2;6 year. It is proven that for VP children in this age-group, phonological proficiency is related to morphological complexity. This current study showed that VP children with SSD concur with morphosyntactic problems comparable to FT children with SSD. The nature of the speech and language problems of VP children can be compared to the problems of FT children.

To obtain an overview of the morphosyntactic structures for the remaining GRAMAT age-groups and the relation with phonological development, a longitudinal design is needed to ensure an effective intervention which may improve long-term outcomes.

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Tables

Table 1

Participant characteristics (n = 20)

P	Gender	GA	BW	UCA	CA	IQ	TBQ	NAC
1	F	29 2/7	900	2,4	2,2	105	100	4
2	F	30 6/7	1680	2,2	2,0	90	80	1
3	M	29	1190	2,4	2,1	90	80	6
4	M	31 6/7	1660	2,2	2,0	90	98	7
5	F	28 5/7	1280	2,2	2,0	110	101	1
6	M	28 5/7	1395	2,3	2,1	110	93	6
7	M	28 6/7	1545	2,2	2,0	115	96	2
8	F	28 3/7	760	2,5	2,2	100	80	4
9	M	31 6/7	1275	2,3	2,2	100	90	3
10	F	27 2/7	790	2,3	2,0	95	86	1
11	M	24	708	2,6	2,2	95	101	3
12	M	24 4/7	845	2,5	2,1	100	83	6
13	M	28 6/7	1450	2,2	2,0	105	96	0
14	M	25 5/7	1000	2,5	2,1	105	75	2
15	F	28 2/7	820	2,6	2,3	90	87	4
16	F	29	920	2,3	2,0	100	101	3
17	F	30 6/7	1425	2,3	2,1	105	104	6
18	M	24 5/7	795	2,4	2,1	105	91	1
19	M	29 3/7	808	2,3	2,0	110	105	1
20	F	26 2/7	870	2,4	2,1	90	80	6
Mean		28 3/7	1105,80	2,36	2,09	100,50	91,35	3,35
(SD)		(2 2/7)	(328,95)	(0,13)	(0,91)	(7,93)	(9,44)	(2,21)
Min		24	708	2,2	2,0	90	75	0
Max		31 6/7	1680	2,6	2,3	115	105	7

Abbreviations: P: Participant, F: Female, M: Male, GA: Gestational Age (weeks, days), BW: Birth Weight (grams), UCA: Uncorrected Age (years, months), CA: Corrected Age (years, months), IQ: Non Verbal Intelligence Quotient, TBQ: Receptive Language Quotient, NAC: Number of Acquired Consonants – in initial position, SD: Standard Deviation, Min: Minimum, Max: Maximum

Table 2

GRAMAT-stage and age

Stage	Age
I	1;0 – 1;6
II	1;6 – 2;0
III	2;0 – 2;6
IV	2;6 – 3;0
V	3;0 – 3;6
VI	3;6 – 4;0

Table 3

Interquartile ranges MLU and MLU5 for typically developing children in accordance with the GRAMAT manual

	MLU			MLU5		
	Q1	Q2	Q3	Q1	Q2	Q3
2;0 – 2;6	2.23	2.45	2.88	4.40	5.60	6.60

Table 4

Inter- and intrarater reliability

Interrater reliability analysed utterances		Interrater reliability GRAMAT-analyses		Intrarater reliability GRAMAT-analyses	
N	ICC	Analysis	κ	Analysis	κ
5	.713	1	.773	1	.638
		2	.392	2	.531
		3	.675	3	.437
		4	.439	4	.645
		5	.648	5	.634

Abbreviations: N: number, ICC: Intraclass Correlation Coefficient, κ: Cohens's Kappa

Table 5
Utterances

Participant	Utterances	Unintelligible	Minors	Repetitions	Not analysable	Total analysed utterances
1	196	68	33	3	7	76
2*	135	54	30	1	9	40
3	217	43	53	22	19	78
4	134	32	28	10	3	60
5*	95	36	23	5	3	27
6	236	34	74	16	6	100
7	179	36	21	17	0	100
8	217	49	73	19	1	71
9	113	23	18	3	5	60
10*	182	102	29	4	1	45
11	151	35	51	3	2	59
12	235	53	31	27	4	100
13*	152	34	69	8	3	37
14	285	50	112	15	1	100
15	169	35	26	5	0	100
16	195	23	101	5	7	57
17	265	32	126	21	1	78
18	234	90	62	1	8	71
19*	178	79	61	5	5	28
20	191	79	37	1	12	59
Mean (SD)	187,50 (49,74)	49,35 (22,75)	52,90 (31,71)	9,55 (8,18)	4,85 (4,67)	67,30 (24,45)
Minimum	95	23	18	1	0	27
Maximum	285	102	126	27	19	100

* less than fifty utterances

Table 6
MLU and MLU5 in morphemes

Participant	MLU	MLU5
1	1,17	2,8
2*	1,42	3
3	1,47	3,4
4	1,461	3,4
5*	1,16	2,2
6	1,46	3,8
7	1,62	4
8	1,26	3,4
9	1,29	3,2
10*	1,24	3
11	1,64	4,8
12	2,06	5,4
13*	1,01	2,2
14	1,35	3
15	1,33	3
16	1,18	2,6
17	1,42	3,2
18	1,34	3,2
19*	1,12	2,2
20	1,33	3
Mean (SD)	1,37 (0,23)	3,24 (0,80)
Minimum	1,01	2,20
Maximum	2,06	5,40

* less than fifty utterances

Table 7
Acquired structures

Maximum possible number of structures per stage							
	Stage I	Stage II	Stage III	Stage IV	Stage V	Stage VI	Total
	3	8	21	14	5	3	54
Acquired structures per participant (n = 15)							
Participant	Stage I	Stage II	Stage III	Stage IV	Stage V	Stage VI	Total
1	3	1	8	0	0	0	12
3	3	3	10	1	0	0	17
4	3	4	11	0	0	0	18
6	3	5	13	4	0	0	25
7	3	5	10	1	0	0	19
8	3	3	9	0	1	0	16
9	3	4	9	1	0	0	17
11	3	6	12	5	0	0	26
12	2	6	18	0	0	0	26
14	3	2	9	1	0	0	15
15	3	5	9	1	0	0	18
16	3	6	8	0	0	0	17
17	3	5	9	1	0	0	18
18	3	3	9	2	0	0	17
20	3	1	10	1	1	0	16

Dutch summary

Achtergrond: Ongeveer 1% tot 2% van de geboren kinderen wordt zeer prematuur geboren (zwangerschapsduur korter dan 32 weken). Studies hebben aangetoond dat deze kinderen significant slechter presteren op taaltests in vergelijking met kinderen die niet te vroeg geboren zijn. Prematuur geboren kinderen met een fonologische stoornis zouden een nog groter risico kunnen hebben op het ontwikkelen van een taalstoornis. Meer inzicht in de grammaticale ontwikkeling van te vroeg geboren kinderen met een fonologische stoornis en de relatie tussen de grammaticale ontwikkeling en de fonologische ontwikkeling bij prematuur geboren kinderen, zou kunnen helpen bij het ontwikkelen van vroegtijdige interventie.

Doel: Het beschrijven van de morfosyntactische ontwikkeling bij zeer prematuur geboren kinderen met een fonologische stoornis en het onderzoeken van de relatie tussen de fonologische en morfosyntactische ontwikkeling.

Methode: Een observationele, prospectieve studie met twintig zeer prematuur geboren kinderen, gediagnosticeerd met een fonologische stoornis. De morfosyntactische ontwikkeling werd geanalyseerd met behulp van 'Grammaticale Analyse van Taalontwikkelingsstoornissen' (GRAMAT). GRAMAT biedt een overzicht van de morfosyntactische structuren die jonge kinderen het meest gebruiken. In deze studie worden de morfosyntactische structuren van de leeftijdsgroep 2;0-2;6 jaar beschreven. De correlatie tussen diverse linguïstische uitkomstmaten werd bestudeerd.

Resultaten: Uit de GRAMAT-analyses blijkt dat er sprake is van een achterstand in de morfosyntactische ontwikkeling van minstens een half jaar bij zeer prematuur geboren kinderen met een fonologische stoornis. Uit statistische analyses blijkt dat fonologische vaardigheden gerelateerd zijn aan morfosyntactische complexiteit.

Conclusie: De spraak-taalproblemen van zeer prematuur geboren kinderen met een fonologische stoornis zijn te vergelijken met de spraak-taalproblemen van à term geboren kinderen. Een longitudinale studie is nodig om meer inzicht te krijgen in de morfosyntactische ontwikkeling van de verschillende leeftijdsgroepen en de relatie van deze ontwikkeling ten opzichte van de fonologische ontwikkeling, zodat de juiste interventie aangeboden kan worden aan deze groep kinderen.

English abstract

Background: Approximately 1% to 2% of children are born very preterm (VP) (Gestational Age (GA) below 32 weeks). Studies concluded that VP children perform significantly poorer compared to full term (FT) children on language tests. VP children with a Speech Sound Disorder (SSD) might be at a greater risk of developing a language delay. More insight into the grammatical development of VP children with SSD, and the association between the grammatical and speech sound development in these children, might help design an effective early intervention which may improve long-term outcomes.
Aim: To describe the morphosyntactic development in VP children diagnosed with SSD and to explore the relation between the phonological and morphosyntactic development.
Methods: An observational, prospective study of twenty VP children diagnosed with SSD. Morphosyntactic development was analysed using 'Grammaticale Analyse van Taalontwikkelingsstoornissen' (GRAMAT). GRAMAT provides an overview of the most frequently used morphosyntactic structures of typically developing children between the ages of one and four years old. In this study the morphosyntactic structures of VP children at 2;0-2;6 years of corrected age were described. The relationship between linguistic outcome measures was studied.
Results: GRAMAT-analyses showed many inadequacies and a morphosyntactic delay of at least half a year in VP children with a SSD for the particular age-group of 2;0 – 2;6 year. Statistical analyses showed that phonological proficiency is related to morphological complexity.
Conclusion: The nature of the speech and language problems of VP children of this particular age-group can be compared to the speech and language problems of FT children. To obtain an overview of the morphosyntactic structures for the remaining GRAMAT age-groups and the relation with phonological development, a longitudinal design is needed to ensure an effective intervention is provided which may improve long-term outcomes.

Keywords: very preterm, phonology, morphosyntax, language development

Appendix 1: CLAN commands

CLAN command for coding the %mor-tier:

MOR +t*CHI

CLAN command for calculating MLU:

mlu +t*CHI @ +d

CLAN command for calculating MLUL:

maxwd +t*CHI +g1 +c5 @

CLAN command for calculating TTR:

freq +t*CHI @ +d2

CLAN command for calculating D:

vocd +t*CHI @ +r6

CLAN command for calculating frequency of morphosyntactic structures:

freq +t%syn +o +d2 @

Appendix 2: Abbreviations and explanations of the acquired structures of the GRAMAT profile chart

Clause structures

AA	Adverb Adverb
coord	coordination
OAV	Object Adverb Verb
SAA	Subject Adverb Adverb
SC	Subject Complement
subord	subordination
SVAO	Subject Verb Adverb Object
SVC	Subject Verb Complement
SVO	Subject Verb Object
VSX	Verb Subject Clause element
VX	Verb Clause element
QXYZ	Clause contains four elements and start with a question word
4+	Utterance contains more than four elements

Phrase structures

advadj	adverb adjective
appositie	postmodification
detadjN	determiner adjective Noun
indef	indefinite pronoun
prepN	preposition Noun
preppers	preposition personal pronoun

Morphology structure

ovt past tense