

## **Communication development in young cleft-palate children**

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In the opinion of the Groningen Cleft Palate Team the early posterior and anterior palate closure must lead to a reduction of articulation problems and hyper nasality at an early age. Because of a repaired anatomical status, speech sound can possibly develop in a relatively normal way. When the oral and nasal cavity are separated from each other, oral pressure can be built up and consonants can be pronounced in a normal way. Compensatory movements are no longer necessary, and it is expected that speech at six years of age is the same as in children without clefts. In order to evaluate the Groningen Team approach, the speech and language development of 2;6 year old children with cleft palate is examined and compared to that of children without clefts.

### **METHOD AND MATERIALS**

Fifty cleft-palate children and thirty-two children without cleft palate, aged between 2;0 and 2;6 years, were included in the study. The cleft-palate children (mean age 2;5 years) were treated by the Groningen Cleft Palate Team. All of the children, living in the northern part of the Netherlands (Groningen, Friesland, Drenthe, Overijssel, Flevoland), underwent lip closure at the age of three months, posterior palate closure at the age of ten months and anterior palate closure at the age of eighteen months. As part of the diagnostic and treatment protocol the children were examined on communicative abilities at 2;0–2;6 years of age. Language comprehension, language production, articulation, hyper nasality and hearing capacities were examined by senior speech pathologists and audiologists of the ENT Department, all members of the Groningen Cleft Palate Team.

The children without clefts (mean age 2;3 years) were recruited from playgroups for young children in two different provinces in the northern part of the Netherlands (Overijssel and Flevoland).

*Language comprehension* was measured by means of the Dutch version of the comprehension scales of the Reynell Developmental Language Scales, the Reynell Test for Language Comprehension (RTLTC) (Eldik van et al. 1995). The RTLTC is a reliable standardized test. The reliability coefficient is .88, the test-retest reliability (with a six-month interval) is .69. Like scores on an intelligence test, the raw scores on the RTLTC were translated into quotient scores, with a mean of 100 and a standard deviation of 15. A child is defined as having a language comprehension problem with a deviation of 1.3 SD (Knijff, 2003). As a result, the Language Comprehension Quotient (LCQ) scores were divided into “adequate” (SDQ > 80) and “inadequate” (SDQ < 80).

*Language production* was examined by analyzing spontaneous speech according to the 14 milestones presented in figure 1. These milestones were selected following the principles of the Item Response Theories (Luinge et al 2006). Twenty-eight selected milestones derived from literature were translated into yes/no questions which were subsequently directed to parents of 527 children. The children’s selection procedure consisted of explicit selections and several randomizations. After a Mokken analysis, 14 language milestones out of 28 remained and a Mokkenscale was constructed. The milestones follow each other in time and become more difficult with age. The internal reliability of the final scale is very high (.96). The language production of the children, as judged by senior speech pathologists, is called “adequate” when their language production is at least in agreement with their chronological

age. For children 2;6 years of age this means the presence of milestones 3 (production of ten words), 5 (production of two-word sentences) and 6 (production of three-word sentences). Language production is judged “inadequate” if the child’s language production is worse than fits the chronological age.

*Articulation* was tested by naming pictures. The pictures represent words with CVC syllable structure, such as: *poes* (cat), *muis* (mouse), *wip* (seesaw), *tas* (bag), *sok* (sock), *zon* (sun), *jas* (coat), and *hek* (fence). Dutch research about phonological development in young children pointed out that 11 initial consonants ( /p/, /t/, /k/, /m/, /n/, /s/, /x/, /h/, /j/, /f/ and /w/) and 6 final consonants ( /p/, /k/, /s/, /x/, /m/, /n/) are present in 80 - 100% of 2;6 year old children (Beers, 1995). An articulation problem was defined if these sounds were not present. Also backing and nasalization were scored as deviant. Presence or absence of articulation problems was scored by audible examination by two trained speech therapists.

*Hyper nasality* was tested by imitation of words without nasal sounds: *Kees* (name of a boy), *poes* (cat), *fiets* (bike), *klok* (clock), *stoep* (steps) and *Ida* (name of a girl). Presence or absence of hyper nasality was scored by audible examination by two trained speech therapists.

*Hearing Abilities* were tested with observation audiometry in combination with a tympanogram. Results of behavioral observation audiometry are interpreted as normal or subnormal (30–40 dB), mild hearing impairment (40–70 dB) and severe hearing impairment (>70 dB). In a tympanogram the compliance or mobility of the tympanic membrane is measured, which can be related to the condition of the middle ear. Tympanometry assists in diagnosing conductive hearing impairment from perceptive hearing impairment.

### *Statistics*

Descriptive statistics (percentages) were used to describe the amount of communicative problems in the children. For the statistical analysis the children were divided into children with cleft lip and/or palate, children with clefts and a syndrome, and children without clefts. In order to compare the children, the Chi-Square Test was used. Statistical analyses were performed with SPSS 14.0 for Windows (SPSS Inc.).

## **RESULTS**

A total of fifty cleft palate children were tested on language abilities, articulation, hyper nasality and hearing. For the children without clefts (n=32) the hearing examination was omitted. They all had passed the hearing screening of the Dutch National Health Care Service at nine months of age and, in the opinion of the parents, they had normal hearing capacities at the time of testing. Research data from screening of school children shows an average of 3% for a hearing loss of more than 30 dB (NSDSK, Dutch Foundation for Deaf Children).

The children with clefts could be divided as follows: children with cleft lip (n=7), cleft lip and palate unilateral (n=16), cleft lip and palate bilateral (n=10) and cleft palate (n=10). Another seven children showed some form of cleft in combination with a syndrome diagnosis. For the statistical analysis three groups were formed: children with cleft lip and/or palate, cleft children with a syndrome, and children without clefts. Significant differences in the children with cleft lip and/or palate (without a syndrome), compared to the normal children were found for hyper nasality (34% vs. 0%,  $p = 0,001$ ) and hearing problems (55% vs. 0%,  $p = 0,001$ ). For these aspects of the communicative development, the children with a syndrome diagnosis did not differ from the other cleft palate children (hyper nasality 40%, hearing problems 71%).

For language comprehension, language production and articulation there were no significant differences between the cleft lip and/or palate children and the normal children.

The syndrome children differed from the other two groups of children only in language comprehension and language production.

The results are shown in table 1.

<i>Type of Cleft</i>	<i>Language Comprehension</i>			<i>Language Production</i>			<i>Articulation</i>		<i>Hyper Nasality</i>		<i>Hearing Problems</i>	
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	
<i>Cleft Lip</i>	7	0	0/7	29	2/7	33	2/6	0	0/7	29	2/7	
<i>Cleft Lip Palate Uni</i>	1 6	15	2/13	25	4/16	80	12 /15	50	7/ 14	56	9/ 16	
<i>Cleft Lip Palate Bi</i>	1 0	17	1/6	20	2/10	70	7/ 10	30	3/ 10	63	5/8	
<i>Cleft Palate</i>	1 0	0	0/7	10	1/10	50	5/ 10	40	4/ 10	67	6/9	
<b><i>Total Cleft</i></b>	<b>4 3</b>	<b>9</b>	<b>3/33</b>	<b>20</b>	<b>9/43</b>	<b>63</b>	<b>26/4 1</b>	<b>34</b>	<b>14/4 1</b>	<b>55</b>	<b>22/4 0</b>	
<i>Cleft + Syndrome</i>	7	40	2/5	33	2/6	57	4/7	40	2/5	71	5/7	
<i>No Cleft</i>	3 2	0	0/26	4	1/23	44	10/ 23	0	0/ 28	0	0/ 32	

**Table 1** *Communicative abilities in children with (n=50) and without (n=32) clefts; 2;0 – 2;6 years of age*

From Table 1 it also can be deduced that not all children between 2;0 and 2;6 years of age are willing to cooperate with the testing procedure. For the two groups, children with and without clefts, this is shown in Table 2.

	<i>Children with cleft, n=50</i>		<i>Children without cleft, n=32</i>	
<i>Language Comprehension</i>	12	24%	6	19%
<i>Language Production</i>	0	0%	9	28%
<i>Articulation</i>	2	4%	9	28%
<i>Hyper Nasality</i>	2	4%	4	13%
<i>Hearing Problems</i>	3	6%	-	

**Table 2** *Number and percentages of children not cooperating during the testing procedure*

## **DISCUSSION**

The aim of the Groningen Cleft Palate Team, which is almost normal speech and language development in children with cleft, for children by the age of 2;6 years, the aim is reached for language comprehension, language production and articulation. For the aspects hyper nasality and hearing, the aim is not yet reached by the age of 2;6.

### *Language development*

Albeit that there are no significant differences between non-syndrome children with clefts and normal children on the aspect of language development, some considerations can be made. In the cleft palate children more problems with language comprehension (9% vs. 0%) and language production (20% vs. 4%) were present. In children with a normal palate (cleft lip) the problems with language production (29%) might be related to the presence of hearing problems (29%). However, in children with unilateral or bilateral cleft lip the problems with language comprehension and language production are not directly related to the presence of hearing problems. The number of children with hearing problems is higher (30-50%) than the number of children with language problems (10-25%). This means, that despite hearing problems, in most children language can develop in a sufficient way. As all children showed conductive hearing loss, it can be hypothesized that they have periods of normal and impaired hearing, and that the periods of normal hearing are sufficient to develop language.

Children with a syndrome diagnosis differ from other cleft children in their higher percentage of language problems, language comprehension (40% vs. 9%) as well as language production (33% vs. 20%). Most likely this is due to the fact that in syndrome children mental retardation is often part of the problem.

### *Articulation*

In all children, even in the children without clefts, the percentage of articulation problems is rather high and significant higher when compared to the presence of language production problems. This even is the case in children without clefts: 44% were diagnosed as having an articulation problem, whereas only 4% of the children showed language production problems. Therefore, questions could be raised concerning the judgment reliability for articulation in young children. Articulation is a process of growth (Goorhuis-Brouwer and Knijff 2003). In the Netherlands no standardized tests are available to evaluate articulation at this young age. A study of literature on the subject of the development of articulation indicates that the standards for producing a consonant and consonant cluster are ambiguous (Beers 1995, Stes 1997, Dodd et al 2003). It is unknown at this point which consonants are produced by 90% of the children at a young age. Also, it is difficult to differentiate between a child with delayed or disordered articulation development and a child with articulation development within the normal variances (Dodd et al 2003). However, articulation problems are considered to be predictors for reading and writing problems (Eleveld 2005, Steensel 2006). It could be that speech pathologists, influenced by the operative practice of diagnosing and treating as early as possible, differentiate too sharply between normal and deviant. If that is the case, then the percentages of articulation problems in children with clefts, as well as without clefts, could be judged too high.

### *Hyper nasality and hearing*

The most plausible explanation for the presence of hyper nasality is a remaining velopharyngeal insufficiency (VPI) after the palate closure (Persson, 2006, Brunnegård, 2007). Whether pre-existent or due to the palate repair the velum is shortened and cannot reach the pharynx wall. Oral pressure, necessary for a good pronunciation of consonants, can only built up insufficiently and the open communication between oral- and nasal pharynx

causes hyper nasality. Speech therapy and/or a pharyngoplasty is needed for these problems. Possibly, the high amount of conductive hearing loss in all cleft palate children is also caused by the VPI, influencing the working of the Eustachian tube in a negative way.

The combination of hyper nasality and hearing problems indicates that early palate closure is not enough to avoid communication problems. As VPI can cause all these problems a pharyngoplasty can be considered as a next step in the treatment procedure (Pryor et al 2006). Moreover, speech therapy and hearing improvement are recommended.

#### *Cooperation of the children*

Albeit a small number of children, not all the youngsters cooperated with the testing procedure. This was partially due to their young age. Shy behavior and/or understanding problems could be the cause. For language comprehension non-cooperation was about the same in children with and without cleft (respectively 22% and 19%). The same holds for articulation and nasality testing (respectively 4% and 9%). However, as far as the language-production aspect is concerned, the children with clefts cooperated better than did the children without clefts (respectively 100% and 72%). Perhaps children with clefts were more acquainted with examination procedures and therefore showed less shy behavior as a consequence.

#### **CONCLUSIONS**

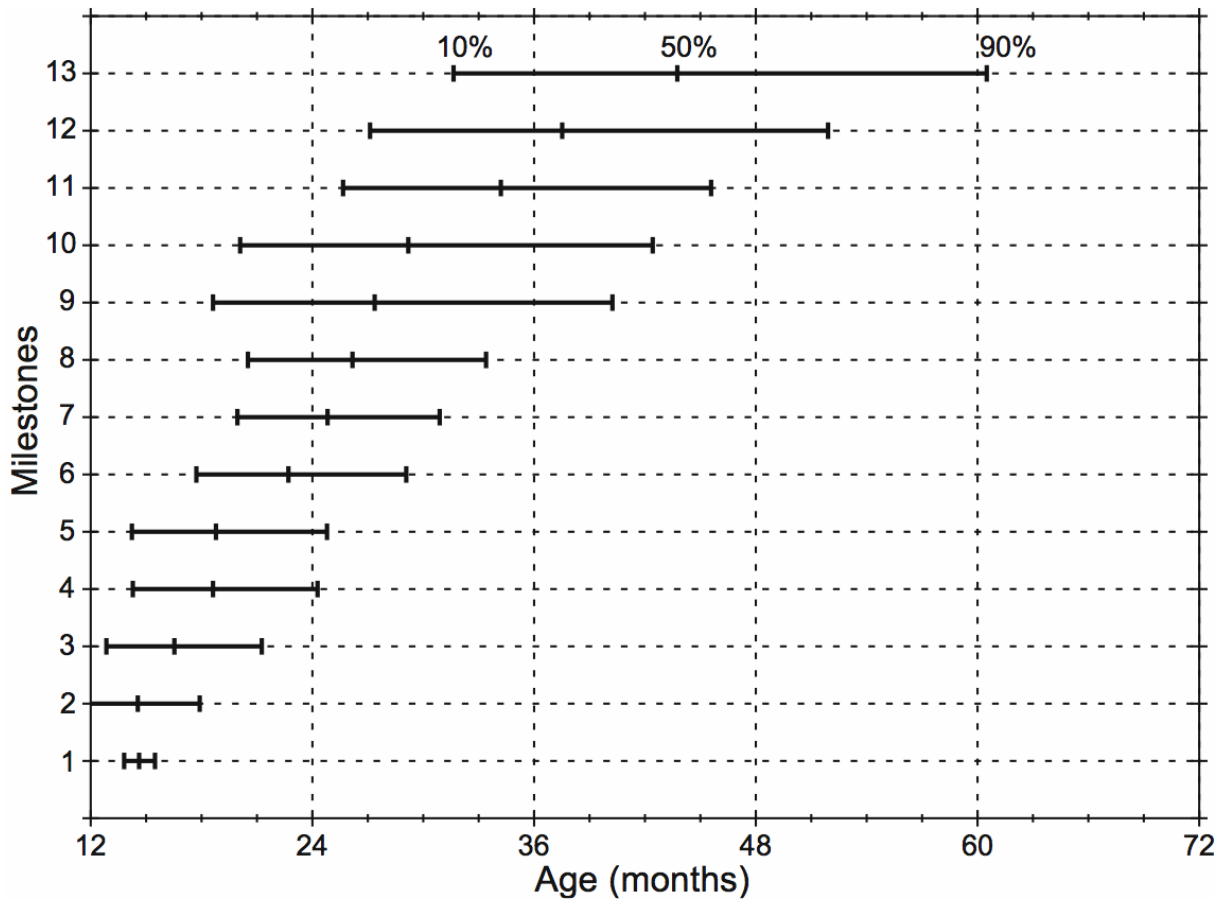
As children with non syndrome cleft lip and/or palate do not differ on language comprehension, language production and articulation, it is assumed that early surgical treatment is effective for a part of the communicative development. They need further treatment for the remaining hyper nasality and hearing problems. Hearing can be improved by grommets, hyper nasality by speech therapy and/or a pharyngoplasty. Future research should be carried out to compare the communicative abilities at 2;6 years of age to those at 6;0 years of age. Progress in communicative abilities, due to therapeutic strategies, can then be properly evaluated.

The high percentage of articulation problems in children with and without clefts may have been influenced by inappropriate standards for articulation development and articulation testing for children aged 2;0-2;6 years. Future research should be carried out after normative data on articulation development to establish an appropriate standard.

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**Figure 1** Milestones in language development reached by 10%, 50% and 90% of Dutch children (n=527) (Luinge, 2006)



1. Comprehends tasks of two words; 2. Is able to point at one or more body parts; 3. Says about ten words; 4. Comprehends sentences of three words; 5. Combines two words; 6. Makes sentences of three words; 7. Makes sentences with three or four words in succession; 8. Intelligibility about 50%; 9. Sometimes tells a story spontaneously; 10. Can repeat a story by some pictures; 11. Intelligibility about 75%; 12. Makes long sentences, also compound sentences; 13. Almost everything understandable; 14. *Adult like speech– not in this figure could not be fitted as function of age.*