ARE PHONOLOGIC PROBLEMS PREDICTABLE FROM PRE-SPEECH VOCALISATION IN CHILDREN BORN WITH CLEFT PALATE?

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ABSTRACT

Studies on normal children and children at risk of developing language problems suggest that it is possible to predict phonologic problems during their pre-speech stage of development. Also with cleft children it has been assumed that such prediction is possible. The main purpose of the present study is to examine this assumption by comparing pre-speech vocalisation with early consonant patterns produced by a group of children born with cleft palate. A matched group of children born with normal velopharyngeal function was included for comparison. The results indicate that prediction is not possible for cleft palate children in the same way as for non-cleft children.

INTRODUCTION

Studies on normal children and children at risk of developing language problems suggest that quantity and diversity of vocalisations in the prelinguistic period are linked to subsequent speech and language development, and that prelinguistic measures seem to predict subsequent linguistic development including phonologic development [1].

Surgery should provide cleft palate children with a competent velopharyngeal mechanism. Nevertheless, velopharyngeal insufficiency may persist for a varying period of time resulting in speech errors such as nasality and nasal emission of air. However, these children are also at risk of developing phonologic disorders which may be phonetic or phonologic in nature. Errors, which initially occur as a consequence of structural and motor deviations may over time become incorporated into the child's developing phonologic system. The compensatory sounds developing by some cleft children may be considered a special case of this category of phonologic problems. Also, children born with cleft palate may be at risk of developing "true" phonologic dis-orders related to overall delays in their expressive language. As with other children at risk of developing language problems it has been assumed that also with cleft palate children phonologic problems may be predictable from their pre-speech vocalisation [2]. Therefore, the purpose of the present study is to compare vocalisation produced by one year old Danish children born with and without cleft palate with their consonant phoneme pattern at age three, in order to determine if phonologic problems in the early speech of three-year-olds can be predicted from their pre-speech along the same lines as for their non-cleft peers.

METHOD

Subjects

The subjects were 17 cleft children (12 of these had also cleft lip) and 17 non-cleft children matched for age and sex. The cleft children had surgery of the palate at 22 months of age. At the pre-speech recording the children were one year old (range: 0;11-1;01), and three years at the early speech recording (range: 2;11-3;03). Thus, the first recording took place about one year before surgery, the second one about one year after surgery. The children with cleft palate were recruited through the Cleft Palate Department in Copenhagen. None of the cleft children exhibited other congenital serious anomalies, neurologic impairment, serious sensorineural hearing impairment or intellectual deficits. Some of them had histories of middle ear problems, but had all received otologic mangement since birth. The non-cleft children were recruited through personal contacts and they had no reported history of speech, language or hearing problems, neurologic impairment or intellectual deficits.

Data collection

The one year old children were videotap-ed in their homes for approximately one hour. The toddler's spontaneous vocalisa-tion was obtained during free play with his og her mother and in some cases also with the father. As to the second recording, the three-year-olds were videotaped at the Cleft Palate Department in Copenhagen. Each child was to name a non-standardized series of pictures (photographs) representing words which include 14 Danish word initial consonants. Each consonant was represent-ed in two different words (photographs). In addition, one picture, which is part of a screening test for four-year-olds, served as basis for conversation with the speech and language pathologist in order to get infor-mation on consonants occurring in semi-spontaneous speech. From a standardized test it appears that children aged from three and a half to four years should manage about two thirds of the phonemes in ques-tion. Thus, a certain differentiation as to phonologic behaviour should be expected with the cleft as well as with the non-cleft children.

Data analysis

The International Phonetic Alphabet with extensions recommended for transcription of disordered speech was used for the ana-lysis based on the videorecordings.

Concerning **pre-speech**, for each toddler 100 consecutive sequences were indepen-dently transcribed by two students in speech pathology under supervision by one of the authors.[1] Non speech-like sounds were ex-cluded. This resulted in 1780 speech-like consonants produced by the 17 cleft tod-dlers and 1711 speech like consonants pro-duced by the non-cleft toddlers. The tran-scription of pre-speech was later controlled for certain aspects by the three authors of the present paper. For each toddler in both groups, frequency of occurrence of various characteristics of his or her consonant in-ventory was analyzed. In the present con-text we focus on the number of different consonantal sounds (DIF) produced by the toddlers, which reflects diversity of voca-lisation, and on the number of sequences produced in 30 minutes (SEQ), which re-flects quantity of vocalisation. The sequen-ces were perceptually separated by means of caesura, a phenomenon known from music.

The consonants in **early speech** were in-dependently transcribed by the three au-thors, who are all familiar with cleft palate speech. When disagreement occurred be-tween the transcribers, the sequence was replayed in an attempt to reach consensus between at least two of the transcribers. With few items no consensus could be reached, and in these cases the sequence in question was omitted from the data set. Also, in case of doubtful lexical meaning the sequence was excluded. Thus, the mate-rial for each child informs as to how a given phoneme may be realized, but not as to frequency of occurence of a given reali-zation. The number of identifiable pho-nemes (ID) was analyzed for each child. It should be noticed that whether a phoneme is considered identifiable or not is based on our impressionistic judgement.

A Mann-Whitney U-test was used to de-termine level of significance (one-tailed) concerning differences between the groups.

Assuming that degree of **correlation** re-flects degree of predictability, Spearman's rank correlation (one-tailed, corrected for ties) was used to determine the degree of correlation between ID and various pre-speech characteristics, in the present con-text with focus on SEQ and DIF.

Finally, two of the authors made an un-formal **qualitative description** based on the video recordings of the one-year old tod-dlers with focus on social interaction and communication. This description will only be mentioned in the discussion. It should be added, that these two authors had no know-ledge of the subsequent speech develop-ment, as they were unable to identify the toddlers.

RESULTS

The present paper focuses on the rela-tionship between pre-speech and early speech. Therefore, no general presentation of the childrens' pre-speech vocalisation and early speech will be presented except that in pre-speech, glottal stops and [h] occured more or less with all cleft and non-cleft children, and that significantly more glottal stops were found with the cleft group.

Based on other studies, we considered SEQ and DIF in **pre-speech vocalisation** potential predictors of phonological prob-lems [1]. We find that SEQ is slightly lower with the cleft group, but the differ-ence is not significant (p > .05). Contrarily, DIF is on the average considerably lower with the cleft toddlers than with their non-

cleft peers. Median and range are 6 (1-9) and 12 (5-16) for the cleft and non-cleft group, respectively, and the difference is significant (p < .001).

As to **early speech** ID was used as a measure reflecting the positive aspect of the phonologic capability of the three-year-olds, assuming a negative relationship between number of identifiable consonants and degree of phonologic problemes. Median and range are 9 (3-13) and 14 (9-14) for the cleft and non-cleft group, respectively, and the difference is significant (p < .001). It appears, that none of the cleft children managed all the consonanats, whereas about half of the non-cleft children did.

As to **correlation** between the early speech variable ID and the two pre-speech variables SEQ and DIF, the results are as follows:

Number of sequences(SEQ):
non-cleft group: rho= 0.55 p < .025
cleft group: rho=-0.01 p > .10

Number of different consonants(ID):
non-cleft group: rho= 0.60 p < .01
cleft group: rho=-0.23 p > .10

It appears that only with the non-cleft group we find the expected correlations. However, with the cleft group, a third pre-speech variable correlates negatively with ID:

Frequency of non-initial [h] (% of total number of (a) all consonants and (b) all [h]'s):
cleft group: rho=-0.45 p < .05(a)
                      rho=-0.60 p < .01(b)
non-cleft group: rho= 0.28 p > .10(a)
                      rho= 0.14 p > .10(b)

It should be added that with [h] no significant difference was found between the groups, irrespective of position.

Thus, in spite of the fact that none of the significant correlations are very high, it appears that phonologic problems in early speech produced by cleft children do not seem to be reflected in the same pre-speech variables as with the non-cleft children.

DISCUSSION

As to differences between the groups, we did not find a significantly smaller SEQ-score with the cleft group than with their non-cleft peers, which disagrees with our assumption on pre-speech quantity. However, if quantity of pre-speech vocalisation tends to reduce with development of speech, this may explain the non-significant SEQ-difference between the two groups provided that the cleft group are delayed compared to the non-cleft group. This is supported by the qualitative description of the toddlers, from which it appears that all the non-clefts are more or less at transition to early speech as their vocalisation begins to take on the characteristics of speech as a tool for communication, whereas none of the cleft toddlers show this tendency.

Concerning correlation it can be stated that the results with the non-cleft group support the assumption based on other studies, namely that quantity (SEQ) and diversity (DIF) in pre-speech vocalisation seem to be linked to subsequent speech and language development. However, this does not seem to be the case with the cleft group. As mentioned above children born with cleft palate are at risk of developing "true" phonologic disorders as well as various phonologic disorders which are phonetic in nature. Thus, it seems likely that only with cleft children who develop "true" phonologic disorders, significant correlations between the same variables as found with the non-cleft children should be expected. Unfortunately, our material is not suitable to go into that question.

In the present material we found one correlation which only occurs with the cleft group, namely 'frequency of non-initial [h]': the higher frequency of non-initial [h], the lower ID-score, especially with non-initial [h] compared to the total number of [h]. If this turns out to be true, non-initial [h] should be a valid predictor of phonologic disorders. This may seem plausible, as sequence initial [h] and glottal stops may be considered phonation onset rather than speech-like sounds, and therefore common in the non-cleft group as well. And as [h] can be considered a non-active sound from an articulatory point of view, a high frequency of non-initial [h] might reflect level of speech development. The question is if it predicts specific kinds of problems, as for

instance development of speech dominated by [h] and glottal stops. In the present material the three highest non-initial [h]-scores are found with one toddler whose early speech is dominated by glottal stops, and two with early speech dominated by [h]. But, two other children whose early speech is dominated by glottal stops and [h], respectively, are at the lower end of the range of non-initial [h] scores as toddlers. So, even though no conclusion can be drawn from these few data, it seems worth while to look closer at this point.

One important question is whether compensatory use of glottal stops are predictable from pre-speech vocalisation. From the present material including two cleft children with glottal compensatory articulation, it appears that quantity of glottal stops in the pre-speech vocalisation of one year old cleft toddlers do not reflect development of phonologic use of glottal stops. In a previous study [3] we hypothesize that "teaching-like mothers" are potential candidates for reinforcing speech with compensatory articulation as one of several factors involved in the development of glottal compensatory articulation. Interestingly, it appears from the qualitative description of the pre-speech recordings that with these two children, the social interaction on the part of the mother and sister, respectively, is clearly teaching-like as to communication behaviour. This has not been observed in the other recordings. This observation support our hypothesis, although it still has to be proved.

The present study illustrates the fact that in logopedic research group analyses may be less suitable due to inhomogeneity within the groups. Thus, before conclusion we shortly present two cases from each of the groups, which illustrate that with cleft as well as with non-cleft children research on predictability based on single cases may not be a simple task either. One cleft and one non-cleft toddler whose pre-speech vocalisation apart from glottal stops and [h] is characterized by non-velar consonants really develop fronting in their early speech. However, two other children from each of the groups whose pre-speech is charcterized by velar consonants likewise show subsequent fronting in their early speech. Finally, it should be mentioned that in the vocalisation of one of the cleft children who

develops 'pure' h-speech, few - but non-initial - [h] occur in his vocalisation, while nasals and nasalized sonorants are the dominating consonantal sounds.

CONCLUSION

To conclude, the present study indicates that cleft children with non-active articulatory pre-speech behaviour as reflected in the frequency of occurrence of non-initial [h] may be at risk of developing less identifiable consonants in their early speech. Further, it may be that mothers who are teaching-like in their communication with their cleft toddler are potential candidates for reinforcing compensatory articulation with their child. If these two factors turn out to be essential to the question of phonologic development in cleft palate speech, the clinical consequence could be that more active training with a non-active toddler as a prophylactic intervention may result in development of the active, but very undesirable, glottal compensatory articulation.

The answer to the question if phonologic problemes are predictable from pre-speech vocalisation in children born with cleft palate is a "maybe" judged from the present study, and a considerable amount of complicated research has to be performed before a more final answer can be given.

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NOTE
1. The pre-speech data originate from an A.M. thesis by Anja Bau and Ulla Lahti.