

Type of Reading Disability Related to Cleft Type and Neuropsychological Patterns

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Two groups of cleft palate subtypes (cleft lip and palate and cleft palate only) with reading disability, matched for intelligence, age, sex, and reading level, were compared on reading and neuropsychological test variables. Subjects included 14 males and 10 females of each cleft type ranging in age from 8 to 13. Results showed a significant difference between groups on most language measures and differences in reading comprehension and type of reading errors. Results suggest that children with cleft palate only constitute a language-disorder group with more severe reading disabilities. Children with cleft lip and palate are more likely to have verbal expressive deficits and milder reading problems, possibly related to peripheral speech mechanisms.

Since many children with cleft lip and palate (CLP) and cleft palate only (CP) experience speech and language problems, the relationship of these problems to reading, a language skill, warrants further study. While it is frequently assumed that oral reading errors of children with cleft are related to peripheral speech problems, this assumption has never been empirically demonstrated. Furthermore, the possible differential effects of peripheral speech problems versus specific or general language deficiencies to reading has not been demonstrated.

It has previously been shown that children with cleft lip and palate are more likely to display only a verbal expressive deficit, while children with a cleft of the palate only were found to have a higher frequency of underlying symbolic language deficit in addition to verbal expressive

problems (Richman, 1980). The results of this study indicate the need to differentiate between oral expression and symbolic language in studying the relationship of speech and language problems to reading disability in children with cleft. Furthermore, it has been reported (Richman, 1980) that children with cleft of the palate only who have a reading disability demonstrate more signs of central language deficiency than a noncleft group of reading disabled children matched on intellectual ability levels. In these previous studies, symbolic language or central language skills were considered to be language functions which were separate from peripheral speech, including such cognitive areas as associative language reasoning, verbal mediation, and the use of internal verbal labels in thinking, reasoning, and memory functions. Further investigation of the neuropsychological correlates of reading disability in children with cleft appears warranted in order to further delineate the relationship of peripheral speech versus symbolic language functions to the reading process in these children.

The noncleft reading disability literature contains considerable research demonstrat-

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ing various speech and language functions related to reading deficiency. The previous studies have demonstrated that the ability to segment words into phonetic units (phonetic segmentation) is often deficient in reading disabled children (Shankweiler and Liberman, 1976). Furthermore, it has been suggested that a general verbal processing deficit may be related to reading disability (Vellutino, 1977), and that there are different subtypes of language-based cognitive deficits in children with language related reading disability (Richman and Lindgren, 1980). Although there are different methods of classifying oral reading errors, Boder (1973) has developed a system which classifies oral reading errors as either phonetic errors (based on word attack, sound-out skills) or sight word errors (based on initial consonant, word shape). Boder refers to the first type of phonetic error as dyseidetic and to sight word errors as dysphonetic. Furthermore, it has been demonstrated that approximately 62% of one research group of children made predominantly dysphonetic errors, 9% were primarily dyseidetic, and 21% showed mixed errors (Boder, 1973).

Within the study of reading disability in children with cleft, it would appear important to investigate the relationship between peripheral speech problems and the ability to perform phonetic segmentation. If cleft children have reading problems related primarily to phonetic difficulties, this may be primarily related to the peripheral speech problems. However, children with cleft who show other types of reading errors may have problems beyond just peripheral speech difficulty related to reading deficiency. Since it has been demonstrated that a relatively high proportion of children with cleft do have significant reading problems (Richman and Eliason, 1982), further study of the reason for this high incidence is important.

The purpose of this study is to compare children with cleft lip and palate to children with cleft palate only on intellectual, cognitive, and neuropsychological variables in order to assess the possible differential relationship of specific skill areas to possible reading problems. The primary research

question is whether reading disability in children with cleft is related more to peripheral speech problems or to symbolic language problems. One hypothesis is that children with only phonetic word errors will have very few other cognitive disabilities and their errors may be related only to peripheral speech problems. It is also hypothesized that children who have either sight word errors or reading comprehension problems will demonstrate other language and/or neuropsychological deficiencies which may be related to their reading problems.

Sample

Children were selected from voluntary participants in the University of Iowa Cleft Palate Research Program. An age range of 8 to 13 years was selected since this includes the lower age level at which reading disability could be reliably determined and restricts placement to primarily elementary grade school. All elementary age children were initially screened for reading disability during a routine Cleft Palate Clinic visit. The criteria for selection included: Average Full Scale IQ on the WISC, reading at least one year below grade level on the Wide Range Achievement Test, being within the third to sixth grade in school, the presence of cleft lip and palate or cleft palate only with no other genetic syndromes or neurological anomalies which might be related to intellectual or learning process, and no significant hearing loss (mean loss of worst ear at 500, 1000, 1500 cps less than 30 dB) at the time of testing.

The subjects selected according to the criteria included 14 males and 10 females of each cleft type who were matched according to sex, age, IQ, and level of reading skills (Table 1). Children from both groups displayed some apparent verbal deficiencies in spite of overall Average Full Scale IQ. Both groups had a relatively lower Verbal Scale IQ than Performance Scale IQ on the WISC (a common finding in cleft samples). The speech ratings identified in Table 1 were based on speech clinicians' ratings of overall intelligibility of connected speech sample on a 1 thru 7 scale, with 1 representing normal speech and 7

TABLE 1. Mean Age, IQ, and Speech Ratings of Cleft Palate Only and Cleft Lip and Palate Subjects

<i>Variables</i>	<i>CP (n = 24)</i>	<i>CLP (n = 24)</i>
Age (years)	10.53	10.64
WISC IQ: Verbal	85.37	84.98
Performance	103.67	104.82
Full Scale	94.32	94.78
Speech*	3.68	3.83

* Based on a 1–7 scale of connected speech samples (1 = normal speech, 7 = severe)

severe speech problems. The reliability and validity of this scale have been demonstrated in several previous studies (Morrison, 1955; Spriestersbach, Darley, and Morris, 1956; Morris, 1962; Moll, 1968).

Method

All subjects received individual assessments by a psychologist. After the initial reading screening and intelligence testing for subject selection, neuropsychological evaluation and more comprehensive reading assessment was undertaken. The tasks were selected from various neuropsychological test batteries on the basis of previously identified patterns in noncleft language-reading disability children (Richman and Lindgren, 1980). This previous research suggested that sequencing memory and associative reasoning skills were especially important variables differentiating noncleft children who had language based reading disability. The tasks were selected from several test batteries designed for use with language deficient individuals.

PICTURE ASSOCIATION. This subtest of the Hiskey-Nebraska Test of Learning Aptitude requires the subject to compare two stimulus pictures and identify a third picture from an array of four which fits into the same category suggested by the two stimulus pictures. The score is the number of pictures correctly identified (Hiskey, 1966).

AUDITORY ASSOCIATION. This subtest of the ITPA requires the subject to generalize an association between word pairs to form an analogous association for another word, e.g., "a man maybe a king, a woman may be a —." The score is the total number of associations correctly given.

WORD FLUENCY. This task requires the subject to make verbal associations to different letters of the alphabet by saying all of the words one can think of beginning with a certain letter. The three letters, f, a, and s, are given, and the score for each trial is the number of words given in one minute. The total score is the sum of the three trials (Spreeen and Benton, 1969).

KEY AUDITORY VERBAL LEARNING TEST. This test consists of five trials of immediate memory on a 15 word list. The total score is based on the sum of words recalled over all five trials. Although there are different aspects of the test, only the five trial portion was used (Rey, 1964; Lezak, 1975).

DIGIT SPAN: FORWARD AND BACKWARD. Digit recall was assessed via the Digit Span of the WISC. The number of digits correctly recalled in the longest trial was used as the score for forward and backward separately, as suggested by Crockett (1974).

SENTENCE REPETITION. This test is designed to assess the child's ability to repeat sentences of progressively increasing length. The score is the number of sentences repeated correctly (Spreeen and Benton, 1969).

JUDGMENT OF LINE ORIENTATION. This is a visual matching task that makes no demands on short-term memory or motor performance. Thus, it provides a relatively "pure" test of visual-spatial perception by asking the child to judge the directional orientation of straight lines. The score is the total number of items answered completely correctly and normative standards for children are available (Benton, Varney, and Hamsher, 1978).

BENDER VISUAL MOTOR GESTALT TEST. This is a test which requires pencil drawings of geometric shapes and is primarily a visual motor copying task (Bender, 1946).

READING ASSESSMENT. All children initially received the Word Recognition subtest of the Wide Range Achievement Test (Jastak and Jastak, 1978). This task requires the naming of words in isolation. The Standard Reading Inventory was subsequently administered to all children who

were included in the study. This reading test assesses oral reading in context through reading of stories as well as reading comprehension, reading rate, and type of reading errors made on reading of meaningful stories (McCracken, 1966). Reading scores for each subject included: Word Recognition (Standard Score from WRAT), Comprehension (The level at which the child answered at least 80% of the comprehension questions accurately), Sight Word Errors and Phonetic Errors (SRI reading errors were classified on the basis of Boder's typology). Not all errors were clearly classified and these were not used in the analysis.

Results

The results of the t-test comparisons for each of the neuropsychological tests between the cleft palate only and cleft lip and palate groups are presented in Table 2. Significant differences were found between the groups on most of the memory and language measures. Children with CLP were significantly higher than children with CP on memory for words and sentences. Furthermore, the CLP children were also significantly higher than the CP children on the language association tasks, including Auditory Association, Word Fluency, and Picture Association. There were no significant differences between the CP group and CLP groups in visual perceptual skills (Line

TABLE 2. Means and t Test Comparisons of Cleft Palate Only and Cleft Lip and Palate Groups on Each of the Neuropsychological Variables

Variables	CP	CLP	p
Auditory Memory			
Digits	95.61	99.64	n.s.
Words ¹	72.12	101.35	.001
Sentences ²	75.43	108.27	.001
Language Association			
Auditory Association	71.09	98.76	.001
Word Fluency	81.43	91.72	.01
Picture Association	72.44	109.37	.001
Visual-Perception			
Line Orientation	94.65	98.32	n.s.
Bender VMGT	92.43	96.43	n.s.

¹ Rey Auditory Verbal Learning Test.

² Sentence Repetition.

TABLE 3. Means, t-Test, and χ^2 Comparisons of Cleft Palate Only and Cleft Lip and Palate Groups on Each of The Reading Variables

Variables	CP	CLP	p
<i>t-test</i>			
WRAT ¹			
Word Recognition (SS)	78.67	79.41	n.s.
SRI ²			
Comprehension (grade level)	2.88	4.21	.01
χ^2			
Reading Errors			
Sight Word	74%	21%	.001
Phonetic	26%	69%	.001

¹ Wide Range Achievement Test.

² Standard Reading Inventory.

Orientation) or on visual motor or graphomotor skills (Bender VMGT).

The results of the comparison of CP and CLP groups on reading disability symptoms are presented in Table 3. There were no significant differences between the groups in word recognition level, as measured by the Wide Range Achievement Test. Both groups were significantly below the mean of 100 (CP = 78.67; CLP = 79.41). This finding is expected since this was the reading test on which the children were originally screened as having a reading disability and also were matched according to levels of reading disability between the two groups. The grade level comparisons of the reading comprehension task of the Standard Reading Inventory indicates that the CP group is significantly below the CLP group in reading comprehension skills (CP = 2.88; CLP = 4.21, $p < .01$). The frequency of types of reading errors (sight word versus phonetic) between groups was examined via a χ^2 comparison. The results, as identified in Table 3, indicate that the CP children made significantly more non-phonetic errors (74% versus 21%), while the CLP group made significantly more phonetic errors (26% versus 69%). The percent of type of reading error does not add to 100% due to the fact that some reading errors were unclassifiable.

Discussion

The results of this study suggest that there are different types of reading pat-

terns with differential underlying etiology for children with cleft lip and palate versus cleft palate only. Children with CP demonstrate significantly lower performance on language association and auditory short-term memory tasks, as well as significantly lower reading comprehension ability than CLP children. Furthermore, the CP children made significantly more sight word errors while the CLP children made significantly more phonetic errors. The sight word error pattern for the CP children suggests that their reading disability is more than could be accounted for due to peripheral speech problems interfering with the ability to sound out words. These findings that CP children with reading disability display both auditory memory and auditory association deficits indicate the possibility of a general language deficiency. This interpretation is further substantiated by the fact that the CP children with reading disability show reading comprehension difficulty which may also be a symptom of underlying language difficulties. It appears that the CP children with reading disability should be further evaluated to determine whether there may be a central nervous system dysfunction for this group of children.

The children with cleft lip and palate and reading disability appear to have only peripheral speech problems related primarily to phonetic reading errors. Most of their scores on the neuropsychological tasks were not only significantly higher than the CP group, but were also within the average range based on normative data. This would suggest that these children with CLP do not have signs of symbolic language deficiency. Furthermore, they appear to have milder reading problems characterized by difficulties with phonics, which is probably related to their peripheral speech difficulty. They also have good reading comprehension skills in spite of phonetic errors, which further supports the contention that they are likely showing only reading errors related to the peripheral speech deficiency.

Results of this study suggest that differential remedial reading approaches may be indicated for children with different cleft types who have reading disability. Al-

though it is not expected that there will be a perfect match between type of reading disability and cleft type, when clinical assessment indicates reading error and cleft type matches consistent with the present study, specific remedial approaches appear indicated. For example, children with CLP and phonetic reading errors will probably benefit from primarily speech correction considerations. Reading approaches should emphasize sight word skills as well as using the context of the story in order to assist in gaining word recognition. Phonetic approaches should probably be avoided with these children until speech problems are dealt with. On the other hand, children with cleft palate and many sight word errors appear to display a much more significant language-based reading disability. Reading approaches which take into account the language deficiency, and language therapy along with reading assistance may be indicated. Reading approaches which emphasize language association skills, such as having children read short passages and tell them out loud, may be indicated to supplement individual language work with these children. It strongly appears that these children's learning problem is likely to be more pervasive, involving a general comprehension and language deficiency which requires more extensive educational assistance.

This study addresses neuropsychological differences by cleft type of children with cleft and reading disability. Further examination of groups of CP versus CLP children with and without reading problems on neuropsychological test performance may be indicated to determine whether the present findings are related only to reading disability or to some more pervasive deficiency.

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